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The Mining Journal

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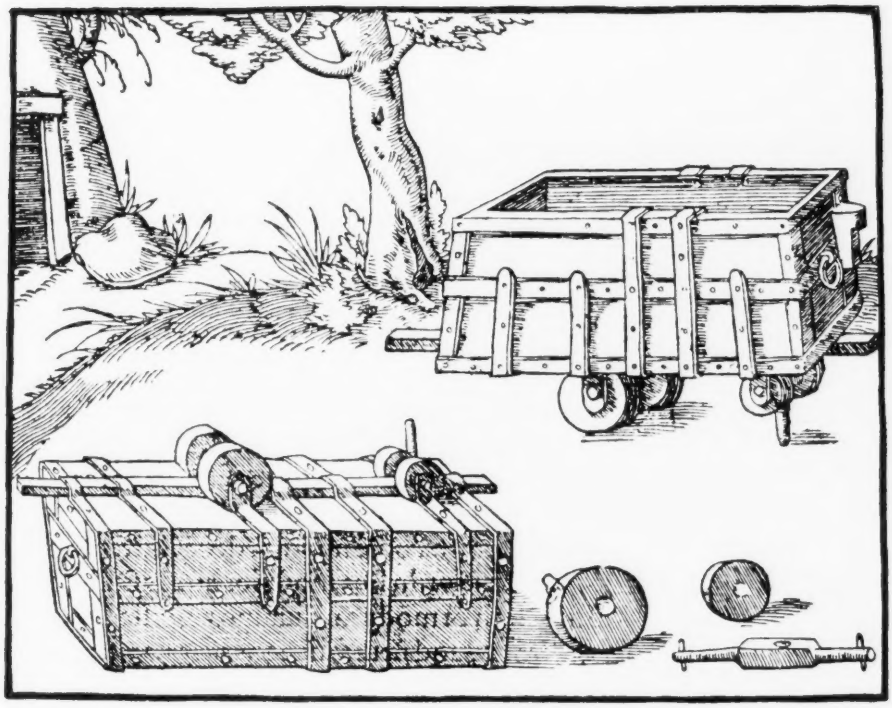

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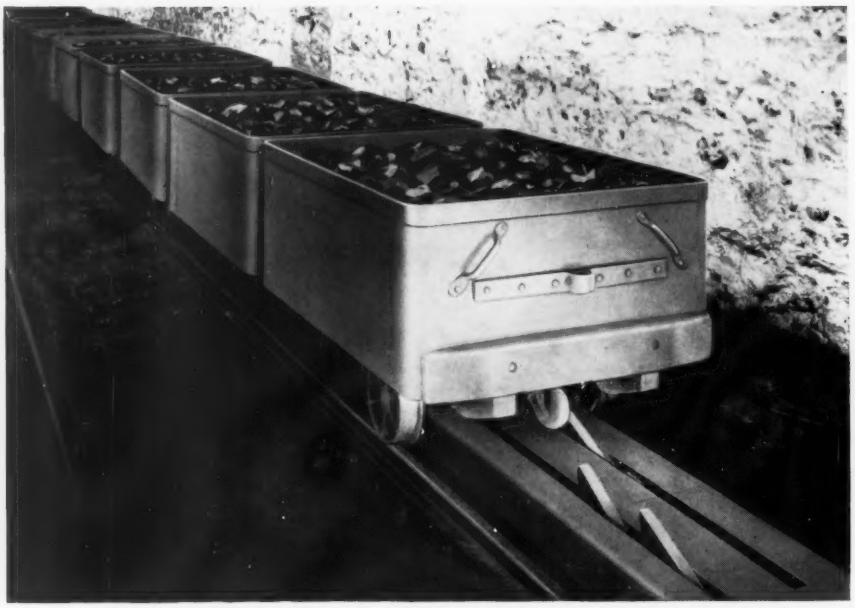

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The Mining Journal

ANNUAL REVIEW

1954 Edition

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The Industry in 1953

THE past year has witnessed the virtual completion of the return to free trading in the products of the mining industry, and a new generation accustomed to strict market controls is learning to adjust itself to the workings of a free market.

Broadly speaking 1953 has witnessed a progressive decline in world metal prices, the beginnings of which were already apparent in the previous edition of this *Review*. To a considerable extent this decline has reflected not so much a drop in consumption as a shifting of sentiment touched off by the cease fire in Korea, by slackening American business activity and by the prospect of surplus production. In fact, despite expanding mineral production, consumption in many cases supported by aggressive stockpiling has fully kept pace with expansion. Moreover, where this has not been so producers, more particularly in the United States, have shown themselves financially able and willing to carry large stocks, at any rate temporarily, and administratively flexible enough to cut back production before the situation got out of hand.

Another aspect of falling prices and more competitive markets has been the growing challenge of alternative materials and the more energetic search for new uses, which in many cases can only mean an intensification of competition between alternatives. At the same time many companies have become painfully aware of the high cost structure imposed upon their operations by the high level at which post-war mining installations have had to be capitalized.

A further important respect in which post-war metal markets differ inescapably from pre-war conditions is to be found in the emergence of the United States as what such authorities as the Paley report, and more recently Mr. Lewis Douglas, have described as a "have not" nation for the majority of the metals it consumes. This condition, coupled with the States' gigantic stockpiling programmes, of which it is partly the direct cause, has resulted in American demand dominating all the metal markets.

Market prognostication became further complicated during the past year by the emergence of Russia as a substantial seller in the free market for a number of metals. Owing to the absence of reliable statistical data regarding the extent or probable duration of production surpluses behind the Iron curtain, it is virtually impossible to forecast the extent of this source of supply. In any event it must be regarded as erratic and determined by the order of politico-economic priorities which obtains for the moment.

Whatever may be the assessment of the short term outlook for the metals, the long term prospect gives promise of fully endorsing the expansionist programmes which are still proceeding in many parts of the world despite recent market declines. A large proportion of this expansion is being under-written directly or indirectly by U.S. Government funds either in the form of loans, support price programmes or guaranteed markets, but granting Uncle Sam the financial resources to carry surplus stocks over a period of business recession, it is difficult to regard the risk he is carrying as very great. In the States in particular, but to a lesser extent in most industrialized or partially industrialized countries, not only are population trends upwards but so also is consumption *per capita* of the earth's physical resources.

While the mining industry is not yet faced, even in the case of lead, with an immediate exhaustion of known resources, the need for large-scale systematic prospecting becomes increasingly urgent and the necessity for working ever lower grade deposits at economic prices is presenting both the mining engineer and the metallurgist with a stimulating challenge to his resourcefulness.

In the very long term, progress in nuclear physics may, of course, alter the present look of the mining industry out of all recognition. Already the prospect of atomic energy being successfully utilized in the generation of power is causing us to revise estimates of coal and oil requirements only 20 or 30 years hence, while the eventual synthetic production of some, at least, of the metallic elements is now within the comprehension of the research scientists.

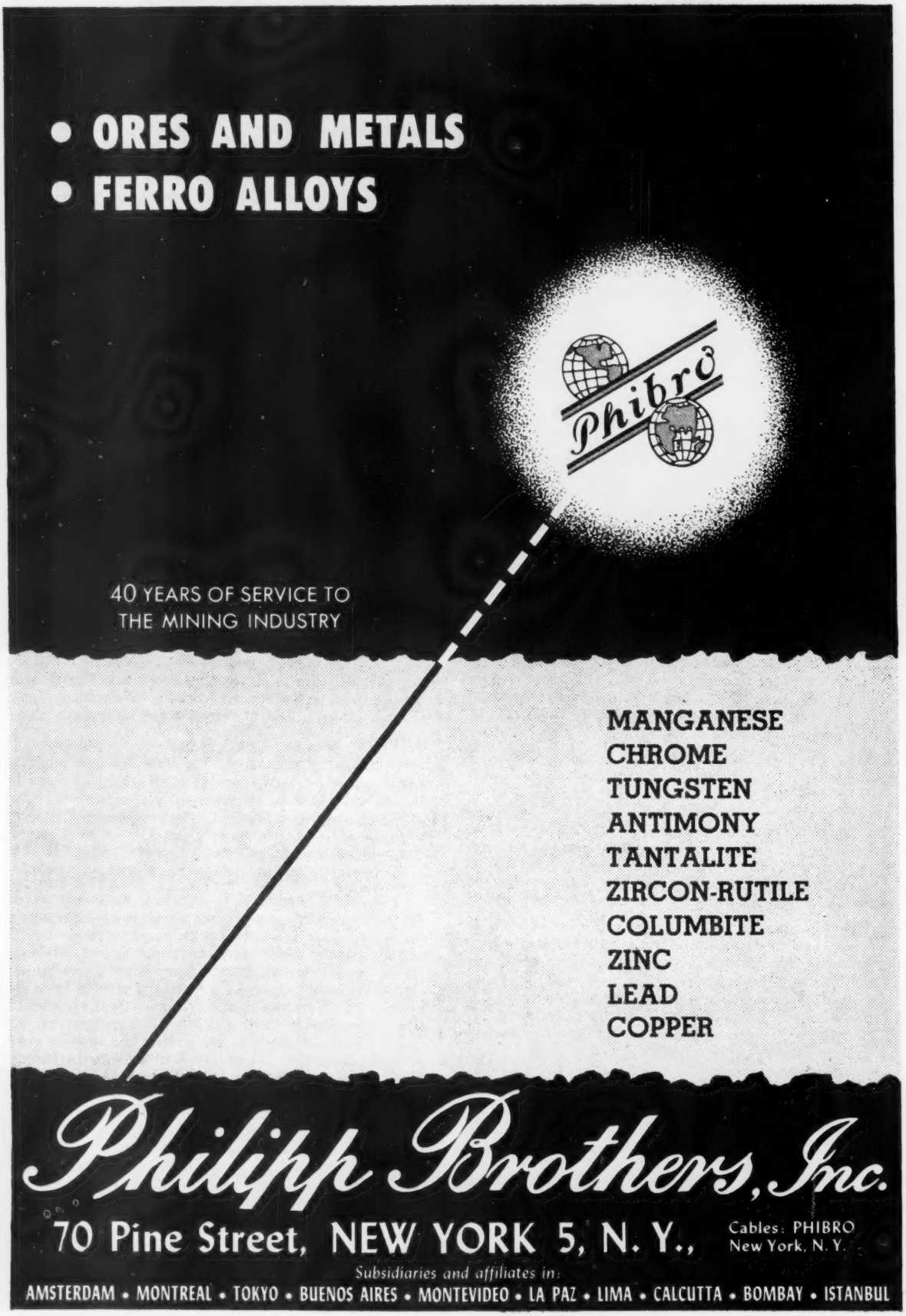
Reverting to the immediate day to day realities of the mining industry, the end of 1953 probably found the prices of both lead and zinc near bottom in that any further substantial price falls appear likely to extinguish a much greater volume of production than consumers could tolerate. In the case of copper, substantial increases in production are in prospect in the next few years, and while in the long term consumption appears certain to keep pace with it, the balance of supply and demand in the intervening period is a matter for speculation. The future of tin is probably bound up more with the attitude of the Western powers to the political outlook in South-East Asia than with the prospect for international tin restriction.

Among the light metals, aluminium was notable for a free world production increase of some 20 per cent over 1952. This metal—the only one of the light metals yet fully established in a commercial sense—is increasingly challenging the older major metals, both ferrous and non-ferrous. Although tremendous efforts are being made to expand the production of titanium, all present production targets are quantitatively a mere fraction of what the potential of this industry is likely to be once a cheap continuous process has been developed for producing titanium sponge. As with titanium so with magnesium its potential utilization is far greater than at present, but here the principal factor limiting its wider use appears to be the development of protective treatments against corrosion for magnesium alloys.

The past year has been a record one for steel, both in the States and in this country. The States last year produced about two and a half times as much steel as before the war and they have an output capacity approximately equal to the total world output in the immediate pre-war years. The production in Great Britain continues to break records and reduce the nation's bill for steel imports. The modernization of the industry is thus bringing its reward.

The outlook for the alloy metals is somewhat mixed. Manganese, chrome and tungsten are all in adequate supply, yet while the market outlook for chrome seems reasonably settled, tungsten prices are as mercurial as ever, while the future outlook for manganese is rendered somewhat uncertain by the possibility of a successful process being developed for recovering secondary metals from open hearth slags. The expansion of nickel production goes on, but even so stockpile demands are limiting the supplies available for civilian uses. The future is bright with the promise of new applications once supplies make this possible. Beryllium, which was so short a few years ago, has doubled in output in the last couple of years and producers are now looking round for new markets, of which an expansion in the use of beryllium copper alloys is perhaps the most promising. In the case both of cobalt and columbium consumption seems likely to be limited only by availability for many years to come.

In the case of the non-metallics, asbestos has during the past year provided a salutary warning to the whole mining industry that, given the chance, consumers will always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The diamond industry had a quieter year but nevertheless a better one than any in its history outside of 1951 and 1952. The 25 per cent decline in sales of industrial stones may only represent a tapering off of stockpiling.

Of the precious metals gold has suffered from the tapering off and final disappearance of premium sales, except in South Africa where uranium will more than make up for any losses on this score. Despite this, some revival of interest is to be observed in a number of countries, and although the immediate outlook for higher gold prices seems no better, the prospect of sterling convertibility is brighter. Silver production suffered last year from the decline in lead and zinc production, but remained a stable market. Platinum production, on the other hand, is continuing to show large expansion although present indications are that industrial demand is keeping pace with it.

Among the energy producing minerals coal production recorded a noticeable decline on both sides of the Atlantic and there seems little doubt that this mineral will have to face an increasing challenge first from oil and natural gas, in which vast output expansions are taking place, and ultimately from atomic power. As regards this latter, information about uranium production is so hedged around with secrecy that it is impossible to guess at world production.

Turning from this brief inspection of the metals to a consideration of the trend of events in some of the principal mining areas, we find 1953 to have been a year of sustained, if not increased, mining activity, although this has not been reflected in overall earnings due to the decline in prices.

The outlook for the industry in South Africa appears definitely brighter than a year ago, due principally to the prospective uranium earnings of many of the gold producers. Beyond this many of the O.F.S. mines are now in the stage of transition from development to full production and for the moment the labour supply position shows welcome signs of improvement. Even so the availability of labour seems likely to impose an upper limit on the Union's present level of mining activity, in the same way as the availability of water may well do so 25 years hence.

In the Rhodesias this past year has witnessed the launching of the Central African Federation. The economic arguments for this required no pressing and it is rather the field of racial relationships wherein lies the crucial test of the feasibility of this big step. The continued expansion of mining in this area depends largely on the timing of the plans for expanding fuel production and power generation.

The Congo had another good year but in recent months the tin industry has been hard hit by the declining tin price from which it had been previously insulated by long term R.F.C. contracts. Mining in East Africa has, despite the native unrest in Kenya, witnessed another year of progress.

Events in British West Africa have been marked by the moderation and keenness which Dr. Nkruma's government has continued to show. Of particular significance for the mining industry has been his proposal to incorporate in the new constitution, to be introduced this year, provision to ensure that if at any time in the future nationalization of any industry becomes necessary fair compensation would be guaranteed to the original owners. In this way Dr. Nkruma has sought to commit not only himself but his successors in office—an example which might well be followed in other countries besides the Gold Coast.

Across the Atlantic we see both the domestic mining industry and the metal markets of the United States continuing to dominate the world mining picture. The first full year of President Eisenhower's administration has witnessed a pronounced recession in mining activity, but there are few signs that this will grow. Certainly the future of the Republican Party in our time depends on its success in fighting off the slump. Consequently we find the Administration in a position where virtually it cannot afford to stop stockpiling and the new stockpiling programme recently outlined by the President seems destined to bring effective support to the domestic industry and indirectly to world markets, which at least are now assured that no precipitate dumping will occur. During the year the issue of tariffs has continued to be fought inconclusively and although it is now clear that White House policy inclines towards trade liberalization and economic support for the underdeveloped areas of the world, the struggle in Congress with the mining lobby is yet to come.

To the north and south of the United States we find contrasting pictures. In Canada the economy continues to boom and the Canadian dollar still has the distinction of being at a premium over the American dollar. The mining industry achieved a record year, not only quantitatively, but also in value despite falling prices. In Mexico the picture is very different. Here the mining industry has been hard hit by falling lead and zinc prices and the effect of currency devaluation has still to declare itself.

Among Latin American countries, the outlook in Chile and Bolivia, both for mining and the nation's finances, is overshadowed respectively by copper and tin. In both countries mining, which is the main economic prop, is dependent both upon foreign markets and on the confidence which the governments' economic policies inspire overseas.

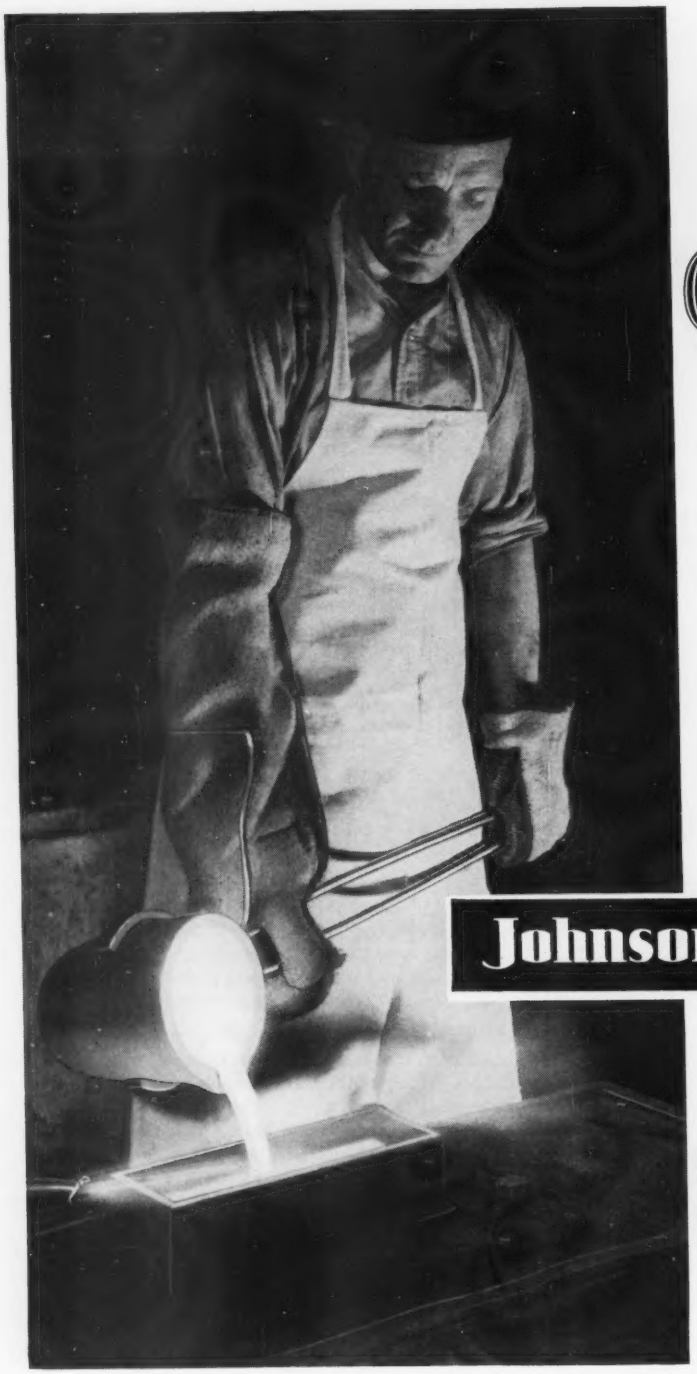
Across the Pacific the year in Australia was marked by some recovery in the gold industry, despite the tapering off of premium sales. Both uranium and oil have been very much in the news, although it is early days yet to assess the real value of the discoveries which have been reported.

Throughout South-East Asia progress in the mining industry itself has been overshadowed by the necessity of estimating the probabilities of a deteriorating political situation and as we write the future of the industry in Thailand, Malaya and Indonesia, and probably over a much wider area, depends primarily upon events in Indo-China.

We have endeavoured on this occasion to give a considerably fuller treatment than hitherto to mining news from Europe. Much of the information about the Continent at our disposal, however, is incomplete and the picture which emerges may therefore seem inadequate. It does, nevertheless, serve to emphasize that, outside of coal and iron, Western Europe is not one of the world's major mining areas, being a substantial net importer of many minerals.

In Great Britain the introduction of the new Mines and Quarries Bill has been a notable event, more especially for the attempt which has been made at redefining the duties and responsibilities not only of the mine manager, but also of the mine owner as well. Despite certain budget reliefs H.M. Government still shows no awareness of the urgent fiscal measures necessary both to ensure Britain's continuance as a leading international mining finance centre and also to revitalize the domestic mining industry.

With this edition of the *Annual Review* we carry our continuing historical record of the world's mining industry past another milestone. In some respects we believe that our report on 1953 is more complete and easier of reference than those which have preceded it. At the same time we ask the reader's indulgence both for its statistical incompleteness and for the inevitable errors of emphasis, if not of fact, which cannot be eliminated in a review of events covering so wide a canvas and written so soon after the event.



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Gold By E. BALIOL SCOTT

GOLD mining continued last year under the shadow of its eclipse due to war exigencies but there were some signs that the gloom was lightening. The withdrawal of all restrictions by the International Monetary Fund on the free sales of gold enabled a more realistic assessment to be made of its value and usefulness in international finance while the re-opening of the London gold market indicated an advance towards the adoption of a gold standard and currency convertibility.

Production

The world's total output showed little change from 1952. Ignoring for the moment the U.S.S.R., whose contribution is as unascertainable as ever, computations vary between a small decline (63,000 f.oz. according to the Union Corporation) and a somewhat larger gain of around 100,000 f.oz. according to Dr. M. A. Kratz writing in the *Engineering and Mining Journal*—differences due generally to the absence of official figures when the compilations were made.

The accompanying table represents our own computation reflecting figures which have become available in the interval since these two estimates were published.

WORLD GOLD PRODUCTION
(in fine ounces)

	1952	1953	Increase or Decrease
Un. of S. Africa	11,819,602	**11,939,593**	+ 119,991
Canada	4,471,725	**4,068,516**	− 403,209
U.S.A.	1,886,036	**1,964,676**	+ 78,640
Australia	978,000	**1,052,779**	+ 74,779
West Africa ..	713,687	**733,740**	+ 20,053
Rhodesias	497,000	**501,366**	+ 4,366
Philippines ...	469,408	**480,625**	+ 11,217
Mexico	459,000	**450,000***	− 9,000
Colombia	422,240	**436,045**	+ 13,805
Congo	384,441§	**394,743§**	+ 10,302
India	243,000	**212,000**	− 31,000
Japan	201,000	**200,000***	− 1,000
Chile	177,000	**180,000***	+ 3,000
Brazil	180,000*	**180,000***	—
Peru	140,000*	**140,000***	—
New Guinea .	127,000	**120,000***	− 7,000
Fiji	95,000*	**95,000***	—
Sweden	70,000*	**70,000***	—
Tanganyika ..	64,693	**69,886**	+ 5,193
New Zealand	59,161	**55,000***	− 4,161
Korea	50,000	**50,000**	—
U.S.S.R.†	2,000,000/ 9,000,000	**2,000,000/ 9,000,000**	—

* Estimated. § Export. † Conjectural.

One of the most interesting developments in the gold situation has been the re-opening of the London gold market. Though its actual achievement was only reached on March 22 of the current year, negotiations and preparations had been going on for a considerable time previously, and the arrival by sea and by air of relatively large consignments of gold from the U.S.S.R. towards the end of the year presumably facilitated the implementation of the scheme. The London gold market, which had been closed for 15 years, has not so far been completely liberated. Sales have been completely freed, but purchases are still restricted. Limited as it is compared with the pre-war freedom, it appears to be regarded with some envy in the United States where, in the recent hearings before the Senate Sub-Committee, its imitation was recommended by various gold interests.

Russian Gold

An interesting feature of the year was the sale abroad of large stocks of Soviet gold. The exact figure is not known but Mr. Harold Stassen, Director of U.S. Foreign Operations Administration, stated in January last that the U.S.S.R. was estimated to have shipped abroad considerably more than $200,000,000 worth of gold—say 6,000,000 oz.—more than any country except South Africa and, possibly, the U.S.S.R. itself, produced last year. The U.S.S.R. sold at first on the Continental free markets for the sake of the premium but when this ran off consignments were switched to the Bank of England.

The Russians appear to need sterling partly because some Soviet *bloc* exports have declined but largely because of their apparent attempt to implement Malenkov's new post-Stalin policy of raising the standard of living. In any event, the exchange of Russian gold for British sterling must be considered as a normal function of gold in a free economy and helps to negative the idea that their undoubtedly large gold stocks might be used in an attempt to disrupt the exchanges in the Western world.

Gold has been intensively mined for the last 50 years and actively for far longer: many fields and mines have dropped out during the period and in some cases gold as a by-product has become the major source of output. Extraction at the current rate of say 26,000,000 to 30,000,000 oz. a year poses the question of the necessity for new discoveries, now that the need for gold is generally acknowledged, and consequently for more risk capital investment. The emergence of uranium as a sweetener cannot be widely anticipated outside of South Africa. Consequently price stimulation is essential if gold is to hold its place in the general advance made in production by other metals and minerals and world trade generally.

The Gold Price

What, then, appear to be the prospects of a rise in the world gold price? All we can say is that they seem to us to have improved somewhat since our last year's *Review*. Revaluation of gold would be welcomed in gold producing countries, especially the British Empire, which turned out some 72 per cent of last year's world output, if we estimate Russia's contribution at no more than 2,000,000 oz. The United States alone presents an effective barrier to revalorization and the dollar, as the arbiter of the value of the fine ounce, still forms an important part of the world's monetary reserves.

Yet even in the U.S. there seems to be a rising tide in favour of revalorizing the royal metal. Several Bills are now before Congress designed to free gold and break the fetter which binds it to a fixed dollar price. In his election programme President Eisenhower indicated that he was not essentially opposed to liberating gold from its shackles and it came as something of a shock to the advocates of such a policy when at the recent hearings before the Senate Banking Sub-Committee the Deputy Treasury Secretary, Mr. Burgess, and the Federal Reserve Chairman, Mr. Martin, expressed themselves as being firmly opposed to any return to the Gold Standard now.

The advancing trend of Federal debt is widely suspected of being at the root of the objections of those financial chiefs to freeing gold to become the policeman of the politician. However, the conclusions of the sub-committee have still to appear. They will probably be based like other issues largely on the political decisions taken by the Administration in view of the November elections. Meanwhile it would appear that foreign traders are showing increased preference for payment in gold rather than dollars and Treasury stocks fell last year by some $1.1 billion—from $23.186 billion to $22.1 billion in December. In 1949 the gold stock was $24.247 billion.

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Silver By E. BALIOL SCOTT

THE course of the silver market in 1953 was smooth and uneventful and, in accord with the forecast presented in last year's *Review*, of continued stability. After a small rise in early January from 83¼ c. per f.oz. to 85¼ c. in the middle of the month the New York price then remained unchanged throughout the remainder of the year.

The Canadian price reached its apex, 85¾ c. in mid May, due to the premium of the Canadian over the American dollar. For this exceptional price steadiness the policy of the Bank of Mexico in buying and selling silver so as to keep prices steady was, as in recent years, the main stabilizing factor.

The London quotation was based on New York allowing for shipping charges and after rising to 74d. to correspond to the N.Y. advance in mid-January it continued at that figure till December when it dropped ¼d. to 73¾d. at which price it closed the year. This shading of the official price indicated that the trade had access to ample supplies without recourse to the Bank of England, whose selling price remained at 74d. The easier supply position obtaining at that time was demonstrated on December 11 when the Bank of England announced that henceforth silver required for essential industries would no longer be provided from official sources, but that purchases in the dollar area would be permitted if silver supplies from soft currency areas proved to be insufficient.

PRINCIPAL PRODUCERS
(in millions of fine ounces)

	1951	1952	**1953**
Mexico	43.8	50.4	**45.0**
U.S.A.	39.5	39.1	**36.8**
Canada	24.2	24.4	**30.1**
Peru	14.9	17.1	**17.5**
Australia	11.0	10.8	**10.6**
Bolivia	7.2	7.1	**7.5**

The Bombay market provided no developments of interest. Prices ranged from a peak of 96 c. on February 23 to a low of 82½ c. on October 21, finishing the year at a price equivalent to 86 c. per oz.

Production

The world output in 1953, for information on which we are indebted to the U.S. Bureau of Mines, the Canadian Bureau of Statistics, and Messrs. Handy and Harman, declined by some 6,500,000 oz. at approximately 202,500,000 f.oz. For this drop Mexico, with an estimated 45,000,000 oz. (−5,400,000) and the U.S. with 36,776,003 (− 6 per cent) were chiefly responsible. On the other hand, Canada gained considerably and at 30,145,000 oz. (+23 per cent) was not far behind the U.S. Elsewhere, Peru is credited with 17,500,000 oz., Bolivia 7,500,000, and other Spanish American States with 7,500,000, all somewhat better than in the previous year. Australia was again around the 11,000,000 mark, Japan is credited with 6,800,000 oz., while Germany was up to some 2,600,000 oz. Russia has been credited with some 24,000,000, on what authority the writer does not know. Be that as it may, Russia shipped 21,500,000 oz. to London towards the end of last year. If this rate were maintained it would provide a sizeable addition to world supplies.

Consumption

Silver consumption declined more than did output ; being computed at 238,600,000 oz. against 250,200,000 in the previous year—though still remaining considerably above the output of new silver. Of this total, coinage absorbed some 74,800,000 oz. (33,300,000 less than in 1952 when the figure was 108,100,000 oz.). The Saudi Arabian coinage orders were completed in 1952 and Germany also needed nothing for minting.

On the other hand, consumption in the arts and industry improved by some 21,700,000 oz. over 1952 to 163,800,000 oz. and was slightly higher than in 1951. Principal users in this sphere were : U.S.A. 105,000,000 oz.; Germany 17,500,000 oz.; U.K. 11,500,000 oz.; Japan 5,600,000 oz.; and Canada 4,400,000 oz. U.S. consumption in industry and the arts was 10½ per cent up on 1952 and above the average of the previous five years ; it is expected to prove a steadily increasing factor in the silver market, at any rate with prices anywhere near the recent level.

Prices

An important factor in attempting to judge of the future course of prices is the success or otherwise of the efforts now being made by U.S. producers and dealers on the Commodity Exchange to induce Congress to repeal Sec. 8 of the Silver Purchase Act of 1934, which imposed a 50 per cent profits tax on profits arising from the sale of silver. This was imposed to protect the Government when seeking to establish the three to one ratio of gold to silver in the monetary reserves against American speculators. This policy, it is argued, has now been abandoned and to maintain the tax is an anachronism. If the tax were repealed, speculation in silver would revive and the price would rise, which is what U.S. producers and market operators hope for.

On the other hand, consumers naturally do not want to pay higher prices or to lose the stable markets which they have hitherto enjoyed and have taken the stand that repeal should be of the entire silver purchase legislation or of none. The U.S. Treasury is obligated to sell domestic silver output and some portion at least of the Treasury stock at 90½ c., which price therefore constitutes a ceiling.

The " silverites " have made repeated attempts to get the tax repealed ever since it was imposed—so far without success—but with the fierce efforts now being made to undo the work of 20 years of Democratic ascendency and the cry that the mining industry is being destroyed, the proponents of the repeal of the profits tax seem to believe that they have better prospects.

The Outlook

The stocks of free silver in the U.S. Treasury's vaults are steadily declining. Last year they fell by 28,700,000 oz. to 50,400,000 oz., and at this rate should be exhausted in less than two years' time, leaving consumers to depend on domestic mine production plus imports. Nevertheless, no further supplies will be available of demonetized Cuban pesos which constituted the bulk of that country's exports totalling 19,500,000 oz., nor are there indications that fresh sources of supply will develop. On the other hand, we may expect the Bank of Mexico to maintain its stabilizing policy and it is believed to hold between 30,000,000 and 35,000,000 oz. Looking still further ahead the return of some 410,500,000 oz. of Lend-Lease silver must be considered. This should be completed by April, 1957, at any rate for the bulk of this total. Not less than 45 per cent, and possibly the whole, would go into free stocks.

Limiting ourselves to the proposals for 1954, it looks as if there should be ample silver supply to enable the U.S. Treasury to continue selling at its obligatory price of around 91 c.

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The Platinum Metals

PLATINUM'S centenary was fittingly celebrated last year by an exhibition at Grosvenor House, London, which was officially opened by the Duke of Edinburgn on October 19. This exhibition featured Wollaston's achievements in pioneering the production and usage of platinum metals and showed how indispensable these rare metals have become. Although platinum and palladium are widely used in jewellery manufacture, more than 75 per cent of the total output of platinum metals is now used for industrial applications.

Production

The world production of platinum group metals in 1953 is estimated at 725,000 oz. troy, which compares with 668,000 oz. in 1952 and 567,000 oz. in 1946. With a production of 299,177 oz. South Africa has displaced Canada as the largest producer, the Canadian output being about 295,000 oz. troy. Other major producers were the U.S.S.R. (estimated at 108,750 oz.), Colombia (36,250 oz.), and the U.S. (36,250 oz.). Platinum and palladium accounted respectively for 60 per cent and 30 per cent of the total output, the balance consisting of iridium, osmium, rhodium and ruthenium.

The expansion of South African production still continues. Rustenburg Platinum Mines, which took over Union Platinum Mining in 1949, is engaged on a major scheme of expansion designed to bring the combined milling capacity of both mines up to 125,000 s.tons per month. A plant under construction at Rustenburg for the treatment of matte is expected to be completed by the middle of 1954. In Canada, the expansion of nickel production should result in a corresponding increase in the recovery of platinum as a by-product.

Prices

The price of platinum reached its peak in March, 1953, when it exceeded £36 per oz. Platinum then shared the fate of other metals affected by the Korean peace talks and the price dropped to £31 10s., but the closing days of the year saw a reversal of this trend. Increased production from the Rustenburg mines allowed Johnson, Matthey and Co. to stabilize their selling price for platinum in the U.K. at £27 per oz. troy. In February this year, however, the price was increased to £30 on account of rising production costs. In the following month Baker Platinum, which is concerned with the sale of platinum of Canadian origin, reduced its selling price by £2 to £30 an oz. The decrease accompanied a reduction by $6 in the New York quotation. Baker had previously reduced the price of palladium from 165s. to 150s. per troy oz. In announcing the change, the company stated that the reduction was in keeping with the present supply and demand position.

Outlook

With production still rising and Russia re-entering the market, it is evident that platinum's future depends on the expansion of industrial demand. Though platinum has been superseded by vanadium in the production of sulphuric acid, it is reasonable to anticipate that " platforming " and other new uses will provide substantial outlets, provided that prices can be kept stable. Platforming is a process in which platinum is used to convert low-grade petroleum into high-grade. Though it has not yet been fully developed, large sums are being invested in Britain and the U.S. on plants to manufacture platinum catalysts. In view of the resumption of American stockpiling no difficulty is likely to be experienced in the immediate future in disposing of the still expanding output.

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Copper

By URSEL BALIOL SCOTT

FOR the first time in the post-war period the closing months of 1953 found world copper production beginning to reach equilibrium with consumption, excluding, of course, stockpile offtake, which remains unpredictable. In the face of this development, the price of the metal showed a notable firmness throughout last year.

Production and Consumption

As will be seen from the accompanying table, mine output from the principal producing countries of the free world was on balance virtually unchanged from 1952. As between countries, the outstanding change of the year was in the relative positions of Northern Rhodesia, which increased output by some 50,000 l.tons, and Chile, whose output decreased similarly.

MINE OUTPUT OF PRINCIPAL COUNTRIES
(in thousands of long tons)

	1951	1952	**1953**
United States	829	826	**826**
N. Rhodesia	309	312	**362**
Chile	373	377	**326**
Canada	241	230	**225**
Belgian Congo ...	189	203	**206**

The Rhodesian increase was achieved in the face of a continuing fuel shortage and despite the fact that the year was not an easy one as regards Copperbelt labour relations. The detailed progress of the Copperbelt during the year is recorded on page 123 and pages 234 to 236.

The principal cause of Chile's fall in output last year was the 51 days' strike, which stopped production during October and November, and which probably lost the industry some 30,000 tons.

During 1953 copper was progressively freed from controls. I.M.C. allocations ended in February, as did U.S. domestic price and allocation controls. The New York Commodity Exchange re-opened for copper in June and London Metal Exchange dealings began in August.

Free world consumption of new copper has been averaging around 2,600,000 l.tons over the past two years. Of this amount, the U.S.A. has been taking around 40 per cent and is now using about 80 per cent more copper than she was before the war.

Total U.S. consumption in 1953 expressed as deliveries by primary refiners to fabricators amounted to 1,234,500 l.tons, in addition 55,400 l.tons were delivered to the stockpile, which probably did not even replace the emergency withdrawals of the previous year. This offtake was substantially unchanged from 1952. The very high rate of consumption during the early part of the year followed the removal of domestic controls in February. Towards the end of the year demand declined in line with the general industrial recession. Producers' and consumers stocks made notable gains from the very low level of 1952, but were still not excessive. The removal of U.S. price control on imported copper in May, 1952, gave a substantial impetus to imports in that year, which totalled some 863,000 l.tons compared with 809,000 l.tons last year.

Outside the United States consumption declined markedly in the early part of last year, but recovered much of the lost ground with a revival of buying in the autumn once the resumption of dealings on the Metal Exchange had indicated that the expected price slide was not imminent. On the basis of the American Copper Institute's statistics, refined stocks outside the U.S. at the end of 1953 were 250,000 l.tons compared with 116,000 l.tons in 1952.

Prices

In the United States the year opened with a split price basis still in force, domestic copper being pegged at 24½ c., while the price of imported refined metal, and of copper refined from imported ores, was standing at around 36 c. This situation continued until February 25, when the O.P.S. domestic price control was removed, followed shortly afterwards by the suspension of N.P.A. allocations, under which consumers had been obliged to take 40 per cent of their requirements in imported copper. After a period of fluctuation, domestic and foreign metal prices settled down towards the end of April at a uniform 29½-30 c. basis, where they remained until the end of the year.

A major factor in establishing the New York price at what, in European eyes, was an unexpectedly high level, was the refusal of the Chilean government to reduce its official selling price below 35½ c. after the removal of U.S. domestic price control. In consequence, Chilean sales on the world market virtually ceased in the latter part of the year, and something like 125,000 l.tons of unsold Chilean copper had accumulated by the middle of December when the Central Bank re-entered the market. The whole problem of Chile's pricing policy and of her fiscal legislation is discussed more fully on page 153.

The effect of this temporary drying up of Chilean supplies to the U.S. market was to divert additional copper to the States which might otherwise have come on to the European market. It was this factor, coupled with the high rate of U.S. consumer demand in the early part of the year, which served to falsify the bearish assessment of the copper outlook which obtained on the Continental market until after the resumption of London Metal Exchange dealings.

European demand itself contracted noticeably in the early part of the year, a fact which accentuated the general inclination to run down stocks in anticipation of falling prices. Consequently the gap between the Continental copper price and the Ministry of Material's controlled selling price gradually widened to about £25 towards the end of April. At this point, after negotiations with the Rhodesian copper producers, the Ministry reduced its price to £253. Further impetus to the decline of Continental prices was provided shortly after this by the announcement that London Metal Exchange dealings would be resumed on August 5, and the Continental price remained at £10 to £25 below the Ministry's selling price until that date.

Exchange dealings commenced for cash at around £215 with a backwardation of about £15, but, after a remarkably short period for readjustment, the market settled down at a cash price of between £230 and £240 with a backwardation of £10 to £15 until the end of the year.

An important factor in the firmness of the London copper price was the decision, announced by the Ministry of Materials prior to re-opening, that the government would in effect stockpile the bulk of its stocks which had been accumulating rapidly in the preceding months—perhaps to as much as 200,000 l.tons by the beginning of August—and would only make prompt metal available through the government broker when supplies were not forthcoming through other channels. This step, coupled with the fact that Commonwealth producers, who had been previously selling their output to the Ministry on an f.o.b. basis, now had to build up pipeline stocks, resulted in prompt copper being tight throughout the remainder of the year and led to the continuance of the backwardation (see page 27).

Now, as we go to press, the Ministry is withdrawing altogether from the market and for the first time since before the war both producers and consumers have no escape from the necessity of carrying their own stocks. In this

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connection a point on which some controversy is currently centred in Metal Exchange circles concerns the basis of the post-war copper contract which, it is claimed, produces a price at which electro cannot be traded. A return to pre-war pattern is suggested, with a specifiable electro c.i.f. contract and a warehouse contract with sellers' option to deliver standard grades. As a specifiable c.i.f. contract would produce a price for shipment metal, it is questionable if this quotation would be more acceptable than the present one owing to the inevitable premium for nearby metal.

The Outlook

During the early part of this year the principal queries in the copper situation revolved on the one hand round the probable level of American consumption allied to future stockpiling policy, and on the other round Chile's selling policy and her relations with her American-owned mines.

It appears to be fairly widely accepted that U.S. consumption of primary copper may be down this year by as much as 100,000/200,000 l.tons over the 1,250,000 level established during the past two years, a level which, incidentally, was roughly equivalent to U.S. domestic plus Chilean mine output. A portion of this decline may well be offset by cutbacks in production, and there is no means of knowing how much more copper is destined for the stockpile, especially now that the U.S. Administration has indicated its intention of initiating a further vast stockpiling programme, in which copper is certain to be included.

Quite early in the year it became apparent that the American copper producers were of the opinion that they could dispense with overtime working, and in fact all the big companies had, by the beginning of April, reverted to a five day week, which has probably had the effect of reducing U.S. production by the equivalent of about 175,000 l.tons in a full year. Already, however, there are signs that the six day week may be restored in response to reviving demand. Moreover, a large part of this cutback will be offset by the coming into production of various new government-subsidized high cost projects operating on guaranteed floor prices. These new projects will this year build up to a monthly rate of 12,000 l.tons, say 145,000 l.tons in a full year. On this basis effective cutbacks so far made in U.S. domestic production appear small.

The liquidation of Chile's accumulated stocks, which looked so menacing during the early months of this year, now appears to be proceeding fairly painlessly. In addition to the U.S. Government's 100,000 l.ton stockpile purchase, 93,000 l.tons (representing about 75 per cent of current production) were sold in the four months following the resumption of official Chilean sales. Of this total, 31,000 l.tons found its way to Europe without apparently influencing prices. Nevertheless, a growing volume of Chilean sales in Europe must remain the warning signal for any impending price break.

Be that as it may, it is difficult to see the copper price falling to a point which would seriously embarrass either the American producers or the low-cost mines in Chile and Rhodesia. Under the U.S. Government's price support programme (which in some cases guarantees prices as high as 33 c.) the government will have to accept rapidly increasing tonnages as the copper price falls below 25½ c. This, coupled with the fact that a 2 c. import duty becomes automatically effective once the price gets down to 24 c., makes it probable that the copper price will show exceptional resistance to further decline below this level, which is one at which the American producers operated satisfactorily in 1951-52, and there is little doubt that both the Chilean and Rhodesian mines could, if necessary, see the price considerably lower than that.

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Tin

By URSEL BALIOL SCOTT

THE past year has not enjoyed the stable price conditions experienced in 1952, but despite fluctuations in the London cash price between about £975 and £575, world production again recorded an increase, whilst consumption continued to drift downwards.

Production

The accompanying table shows that world production, exclusive of the U.S.S.R., increased last year by some 7,000 tons, which was accounted for mainly by increased production from the Congo, and also apparently from Bolivia, which now claims to be the world's second largest producer. Production in Malaya, which remained steady at about 57,000 tons, is discussed on pages 167 and 252-259.

Generally speaking, the fact that falling prices had no effect on output may be attributed partly to the continuation of deliveries under R.F.C. contracts at better than market price, and partly to the determination of all producers to maintain maximum output, even at some loss, so as to establish the highest possible production basis upon which to be assessed for any quota which may be established under the proposed International Tin Agreement or any alternative scheme.

PRODUCTION AND CONSUMPTION

Mine Production	1951	1952	**1953**
Malaya	57.2	56.8	**56.3**
Bolivia*	33.1	32.0	**34.8**
Indonesia	31.0	35.0	**33.8**
Belgian Congo	13.7	13.8	**17.2**
Thailand	9.5	9.5	**10.1**
Nigeria	8.5	8.3	**8.2**
Others (estimated)†	14.5	15.1	**16.6**
Total	167.5	170.5	**177.0**
Consumption			
U.S.A.	56.9	45.3	**54.1**
United Kingdom	23.9	22.5	**18.6**
Others (estimated)†	59.2	62.7	**55.3**
Total	140.0	130.5	**128.0**

* Exports. † Excluding U.S.S.R.

Consumption

As will be seen from the table, consumption in the free world outside of the United States slumped from 85,200 tons in 1952 to 73,900 tons in 1953. The fact that the same trend was not apparent in the States was due to the fact that in some earlier years consumption had been artificially restricted by controls and that 1953 was the first year since Pearl Harbour (aside from one short period, November, 1949, to January, 1951) in which the American consumer had complete freedom of choice in his use of tin.

Particularly ominous in this downward trend is the fact that it is occurring without any large-scale reduction in industrial activity to account for it. Thus we find world tin consumption running at about the same level as in the years 1930 to 1934, while in the interval industrial activity has recorded a phenomenal increase in the U.S. and to a lesser extent elsewhere. This is the measure of the declining utilization of tin which is being brought about by conservation and substitution.

Stocks

Despite the widening gap between production and consumption, world stocks at the end of 1953 probably showed a small decrease on the year. This anomaly conceals the fact that throughout 1953 the R.F.C. continued to absorb surplus tin under its contracts with the Congo, Indonesia and Bolivia. It was officially stated at the Geneva Tin Conference last November that on the completion of these contracts early this year the U.S. Government would be carrying some 40,000 tons in excess of stockpile requirements. In view of the official statement made in connection with the United States' refusal to sign the International Tin Agreement (see below) to the effect that the R.F.C.'s surplus stocks will be held in " insulation " from the market, this figure will presumably now be increased by the 20,000 tons called for in the third year of the Indonesian contract, the pricing of which was finally agreed recently, and on which deliveries are presumably now commencing.

Prices

After remaining relatively steady for the first three months of the year, prices broke suddenly by £200 during the first fortnight of April, and after steadying for some weeks at around £750 began to drift downwards again at the beginning of June, both cash and forward prices in London reaching a low of £567 late in July.

The price break was very much a matter of sentiment as prompt metal at no time during the year was in abundant supply on the London Metal Exchange. The principal influences were the rumours of peace in Korea—later to be fulfilled—coinciding with the growing prospect of large surpluses coming on the market after the existing R.F.C. bulk contracts had run out in 1954.

A further factor in the initial steep price fall in April was that the drying up of American buying coincided with a hardening of the transferable sterling rates with the consequence that the Continental operators, who had been showing less inhibitions about currency switching operations than had members of the London Metal Exchange, were forced to unload as best they could.

From August onwards prices began to pick up as consumers, already compelled to begin restocking, foresaw the possibility of international tin restriction becoming a reality. In December the average London cash price was just under £650. Throughout practically the whole of the year dealings on the London Metal Exchange were characterized by a shortage of prompt metal and a substantial backwardation (see page 27).

The International Tin Agreement

In December the draft of an international tin agreement was announced at the United Nations Tin Conference which had opened in Geneva the previous month, as the outcome of preparatory work during the year by the Tin Study Group. This draft agreement, the successive stages leading up to its achievement, and the prospects for its ratification have dominated the outlook for tin throughout 1953 and since. The agreement, which would be operated by an International Tin Council based on London, provides initially for a floor price of £640 and a ceiling of £880 which may subsequently be revised. The agreement further provides for the establishment of a buffer stock by means of contributions of tin metal and cash from producing countries sufficient to enable the Tin Council to acquire up to 25,000 tons of tin. The buffer stock manager would be authorized to sell as required whenever the London price rises above £800 and to buy whenever it falls below £720.

The buffer stock can, of course, do no more than iron out short term market fluctuations, and the real teeth of the agreement are in the provision for the establishment of export controls which would come into operation once the buffer stock has reached a minimum of 10,000 tons. The allocation of export quotas would be made proportionately to the voting power of the producing countries and although the agreement places no specific limit on production this is indirectly achieved by placing an upper limit on the stocks which producing countries may carry.

The Outlook

Although ratification of the Tin Agreement by producers is assured, ratification by consumers is still in doubt as we

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go to press. This is largely owing to the decision of the United States not to be a party to the agreement, although assuring the scheme of her benevolent neutrality through her simultaneously announced intention to insulate her surplus stocks from the market. Various other consuming countries which can hardly be expected to benefit greatly from the agreement have yet to ratify, but it may well be that an understandable reluctance to be labelled "the country that wrecked the scheme" may result in the necessary number of votes being forthcoming by June 30.

If the present draft agreement should fail to be ratified, it then remains to be seen whether the producer countries will "go it alone" and establish a restriction scheme more after the pre-war style without consumer participation. Such a move would not necessarily receive unanimous support. Thailand (one of the few countries which could, if necessary, increase output sharply), and Nigeria are known to have hesitated about endorsing the Geneva agreement.

Whether or not a restriction scheme of some kind comes into force, it may not in the long-term be a major factor in determining prices, since in the absence of price maintenance a sufficient number of high cost producers seem likely to close down as to bring production and consumption more nearly into balance at prices which may not be greatly different from those envisaged in the draft agreement.

Meanwhile there are few indications of an imminent decrease in world production. Malaya and Indonesia together report outputs for the first three months of 1954 totalling nearly 1,000 tons above the corresponding period a year ago. On the other hand this increase has been more than offset by the reduction in Congo output where relatively higher production costs have already been making themselves felt since the expiry of the 118 c. R.F.C. contract. In Nigeria, production seems unlikely to decrease if only because of the present drive for columbite production, which in most cases is mined in conjunction with tin.

Bolivia's economy is vitally dependent on continued tin exports as her principal source of foreign currency, and, as already noted, production there is apparently being fully sustained although to what extent selective mining is giving a hostage to the future there is no means of knowing. The Revolutionary Government's immediate anxiety must centre on the future of the Texas smelter which President Eisenhower stated in connection with his budget proposals he was provisionally assuming would close down in the course of this year. If this happens Bolivia will either have to erect her own smelter or sell the concentrates from her Aramayo and Hochschild properties to European smelters, as indeed she did before the Texas smelter was built. The former alternative is one which has been receiving some attention during the past year and should not, in a country with a totalitarian economy, be disregarded simply because it is patently uneconomic.

As regards the Texas smelter itself, its future is still being hotly debated in Washington. Clearly with five or six years supply of tin in the country the Administration must have every incentive to get out of what has proved, commercially, a most unprofitable business. At the same time, on strategic grounds it is difficult to visualize the smelter being dismantled or mothballed and the technical staff dispersed. Thus it may well be that the best solution may be to dispose of the smelter to a private buyer sufficiently cheaply to make its subsequent operation economically attractive.

When all is said, the chief imponderable in the tin situation to-day is the political outlook in South-East Asia, where a French collapse in Indo-China might well upset all preconceived views about tin prices. It follows from this that the United States and other countries of the West must take a decision as to how far they will support the tin price for purely political and strategic purposes. Ratification, or otherwise, of the Tin Agreement must therefore take on an added significance on this account.

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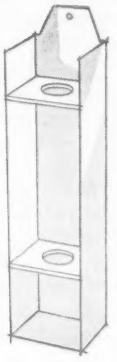

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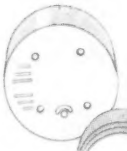

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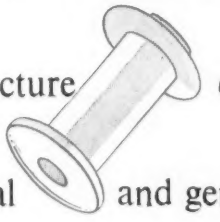

of components in tinplate for the textile, electrical and general engineering industries. The Product Design Section is equally well

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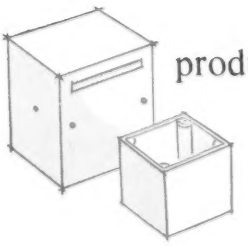

production resources may well solve a difficult component problem, and show the way to reduced costs.

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Tinplate

THE year 1953 saw a further stage in the modernization and expansion of tinplate capacity in Europe and virtually the final stages of the American expansion programme initiated after the outbreak of the Korean war.

MAJOR TINPLATE PRODUCERS
(output in long tons)

Country	1952	**1953**	*Country*	1952	**1953**
Brazil	41,820	**42,000**	Austria ...	40	**40**
Canada ...	234,409	**213,058**	Belgium ..	31,120	**33,555**
Chile	15,746	**18,000**	France	141,984	**192,900**
Mexico ...	11,804	**12,627**	Italy	27,611	**19,388**
U.S.A.	3,618,235	**4,162,087**	Norway ...	7,789	**3,571**
Total			Saar	46,444	**43,430**
America ..	3,922,014	**4,447,772**	Spain	13,511	**13,580**
			U.K.	761,700	**699,600**
India	66,886	**57,367**	W.G'rm'ny	238,122	**140,600**
Japan	86,813	**112,407**	**Total**		
Total			**Europe** ...	1,268,321	**1,146,664**
Asia	153,699	**169,774**	Un. of S.A.	30,108	**25,812**
Total World				5,374,000	**5,790,000**

NOTE The above figures do not include blackplate or terneplate, with the exception of the figures for Western Germany for 1952 where strips and plates (other than tinned) are included. The table needs to be interpreted in the light of American restrictions on the use of tinplate in 1951 and 1952 with a consequent increase in blackplate production (not shown) of about 400,000 tons.

In the U.S.A. controls on the thickness of tin coating which had been in force for two years were lifted early in 1953 and many products, previously restricted to blackplate, were permitted once again to be packed in tinplate. The proportion of tinplate coated electrolytically in the U.S.A. between 1951 and 1953 rose from 65 per cent to 72 per cent, and considerable progress was made in the use of differentially-coated plate. In the U.K. the proportion of electrolytic tinplate increased from 9.5 per cent to 23 per cent in the same period. In Europe Germany is now the only major European producer without a modern continuous strip-mill, as a result of which German tinplate exports declined from 35,000 tons in 1952 to 10,000 tons in 1953. At the same time Belgium's exports rose from 13,800 tons to 21,600 tons (they now represent over 60 per cent of Belgian production) and exports from France rose from 18,000 tons to 71,000 tons.

In the Far East, Japan has purchased modern American plant and has increased its output from 87,000 tons to 112,000 tons.

Total world output in 1953 was approximately 17,000,000 basis boxes compared with 20,000,000 basis boxes in 1952—a fall of 15 per cent, but during the first quarter of 1954 output had risen to an annual rate of over 19,000,000 boxes. There were only 107 handmills in operation at the end of 1953 compared with 181 mills 12 months earlier.

PROSPECTS FOR 1954

What are the prospects for 1954? Export order books remain at a satisfactory level, but there are indications that the South Wales mills will come up against increasing competition during the year in overseas markets. Demand for high quality cold reduced plate, until recently only produced in this country and in America, will be affected by the opening of a new mill in Holland. Output is rising too in France and Belgium, while American mills may be able to offer increasing supplies because of strikes in American can manufacturing plants.

On the other hand, the home consumer may benefit from any slackening of export demand. At home, demand remains very strong, and the prospect is that while overall supply may be adequate for requirements, consumers may find difficulty in obtaining particular sizes and qualities.

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Lead

By Dr. J. A. DUNN

DURING 1953 lead completed its first 12 months of open marketing through the London Metal Exchange. The year was, for lead, a period of comparative price stability. Unlike the other base metals, lead had not been in particularly short supply during the earlier stages of the Korean War, it had not been subject to allocation by the International Materials Conference, and the true market position had not been so obscured by fictitious demands. During 1952 world demand for lead had fallen, and throughout 1953 over-all world supplies were closely related to consumption.

A characteristic of the lead market throughout the year was the proportionately large amount of spot rather than forward dealing. Spot lead was in general in tight supply, and there was at times a considerable backwardation on the London Metal Exchange—as much as £7 a ton in October. In the U.S. lead was generally more freely available than in the U.K.

The tendency to buy from day to day followed largely from uncertainty of future lead prices. This cautious attitude to lead was perhaps natural following the long years of control. Since pre-war days a new generation has come into the metal market, without experience of pre-war open marketing. From sheltered marketing under controls this generation must now feel its way in the rapid-fire day to day transactions.

Amongst the short term factors which contributed to such market vagaries as occurred during the year, were occasional strikes at mines and smelters. But these may be taken as the norm in base metal mining ; perhaps they contributed to the maintenance of the lead price in the £90's for most of the year.

MINE PRODUCTION
(excluding U.S.S.R.)
('000's long tons)

	1951	1952	*1953
U.S.A.	349	343	**300**
Australia	212	228	**250**
Mexico	216	218	**200**
Canada	153	151	**176**
World Total ..	1,715	1,684	**1,690**

* Preliminary figures.

World Production

Production data in the accompanying table are from various sources which can be rarely reconciled. Although final production figures for 1953 are not yet available, such data as there is from the principal producing countries would suggest that world mine production of lead is likely to be at least as high as in 1952, and of the order of 1,690,000 tons. Although there may have been some reduction in output from mines in the U.S.A. this has been fully compensated by increases elsewhere, particularly in Australia and Canada. Much has been said and written about the reduction in output which would follow from the lower prices of to-day ; the main loss in 1953 seems to have been from the closing down of small marginal mines. Some of the larger organizations in America have reduced their weekly operating hours.

Exploration activity continued to be vigorous, although not at as high a level as in previous years.

Prices

On the London Metal Exchange, price fluctuations, when related to to-day's general price level of lead compared with the pre-war general level, were proportionately less than they have been for many years—open-market prices have, so far, been steadier than prices under controls. Opening the year at £103 15s., the price commenced to weaken, ranged for a time between £90 and £95, fell to £74 in April consequent on Korean peace talks, then ranged mainly in the £80's to mid-year, and in the £90's thereafter, with a tendency to weaken at the close of the year.

In the United States the Office of Price Stabilization revoked price control legislation on February 13. The price of lead followed a somewhat similar pattern to that in the U.K. falling from 14.25 c. at the beginning of the year to 12 c. in April, recovering to 14 c. by July, thereafter ranging between 13 and 13½ c. for the remaining five months of the year.

Supply and Demand

Retained imports of lead into the U.K. increased by nearly 50,000 tons over 1952 to 162,000 tons, of which some 100,000 tons was of Australian origin. Consumption was over 300,000 tons (up by 10,000 tons from 1952), of which about half was remelted scrap and secondary and primary metal of domestic origin.

In the United States domestic mines produced rather over 300,000 tons of lead, about 45,000 tons lower than in 1952. Secondary lead was down some 20,000 tons to about 400,000 tons. Imports of refined lead were down 100,000 tons to 355,000 tons, but of lead in matte, etc., were rather higher at 145,000 tons. Consumption was approximately 1,100,000 tons, about 8 per cent higher than in 1952.

The large imports of lead into the U.S. during 1952 and 1953, and the drop in the U.S. price, which followed the London price down, gave rise to increasing concern by U.S. producers throughout the year. Although the problems which have followed from decreased prices have been common to producers throughout the world, the combination of high wage levels and general lower grade of available ore in the United States, has meant an increase in costs per ton of metal probably greater there than in most countries. Proposals have been advanced for support to U.S. producers, mainly by tariffs and import quotas.

In Western Europe lead was in good supply although demand increased in the latter half of the year. Some metal is said to have been shipped to Russia. In Australia, the main source of supply to the U.K., small high cost mines closed down, but the larger producers increased output to partially offset reduced prices.

The Outlook

Lead has now settled into the new general price range which would appear to be the norm of this metal under the present day scale of inflation. The normal limits of this range are likely to be £70 and £100.

Costs must necessarily receive increasing attention. Particularly in the U.S. there has been a decided reduction in grade of available ore and it has been contended that many mines can remain open only if the price of lead and zinc is at 14 c. a lb. each.

Total consumption in 1954 will be quite up to the level of 1953, with demand slightly higher as U.K. and European consumers increase stocks above recent levels. Allowing for strategic and other stocks accumulated in recent years, the present production capacity if fully used would more than meet this demand. The adjustment of this surplus capacity has so far fallen on high cost producers, mainly in America. But if it should be decided that U.S. production is to be protected by some form of tariff protection, the full pressure will be transferred to the weaker producers in exporting countries, mainly Australia, Canada, Mexico and Peru. However, as the general tendency will be for an increase in consumption there seems no need for producers generally to be pessimistic.

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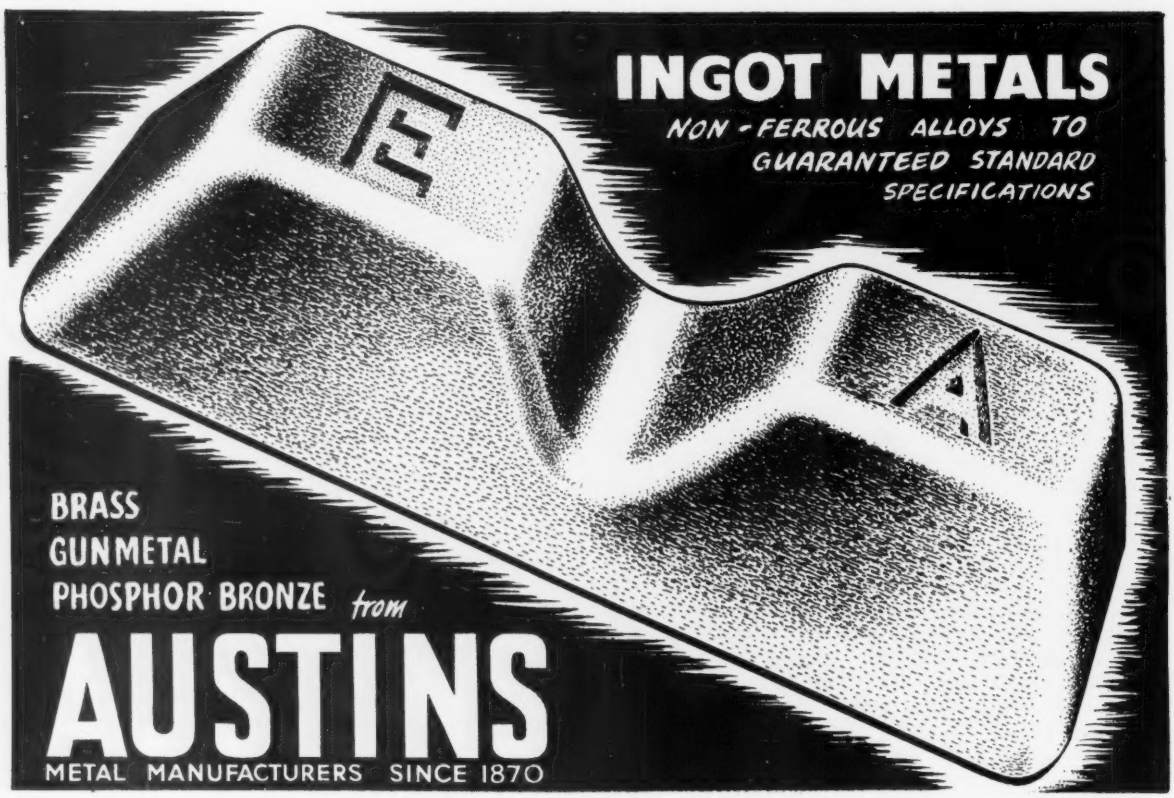

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Zinc

By Dr. J. A. DUNN

THE great improvement in availability of zinc during the latter half of 1952 continued into 1953, and the swing to ample supply was even more pronounced than in the case of its associated metal, lead. The relative supply and price positions of the two metals, lead and zinc, were the reverse of what they had been for many years.

With the recommencement of dealings in zinc on the London Metal Exchange on January 2, the price of zinc immediately dropped and remained at a lower level throughout the year. As with lead, dealings in zinc were characterized by interest in spot rather than forward purchases. This was particularly so early in the year when the large stocks of zinc held by the U.K. Government meant that consumers were assured of metal availability whilst waiting to see what price levels would emerge.

MINE PRODUCTION
(excluding U.S.S.R.)
(000's long tons)

	1951	1952	*1953
U.S.A.	600	590	**485**
Canada	299	332	**356**
Australia	189	196	**225**
Mexico	183	200	**190**
Peru	100	119	**N.A.**
World Total ..	2,326	2,370	**2,320**

* Preliminary figures.

Zinc demand for brass requirements was poor in the first half of the year, whilst consumers were more or less marking time awaiting the re-opening of the copper market in August, so that despite good demand by galvanizers and die-casters, the general over-supply position led to a heavy fall in price levels. Demand improved later in the year, particularly for the higher grades of zinc such as are required by the brass trade. Spot purchases carried a considerable premium over forward metal until near the end of the year.

In U.S. excessive imports created an even greater over-supply than in the U.K. As in Europe fabricators' interests were mainly in nearby metal.

World Output

Such preliminary production data as have become available to date indicate that world mine output of zinc in 1953 was about 2,320,000 tons, some 50,000 tons less than in 1952. Production of refined metal was probably at least as high as in 1952. A greatly reduced mine output in the U.S. was partly compensated by increases elsewhere. This follows the pattern of lead, although the reduction of zinc in the U.S. was greater than for lead as in a number of marginal mines there the ore has a proportionately higher zinc than lead content.

Price

At the end of 1952 the U.K. Ministry of Materials price for zinc was £110 a ton. The London Metal Exchange quotations opened at £96 for g.o.b. on January 2, and in succeeding weeks the level dropped until towards the end of April it reached a nadir of £63 10s. A slow recovery to £74 in July was followed by a swing back to £67 10s. in September, but thereafter it recovered to the £70's where it has since fluctuated.

In the U.S. the 1952 year-end quotation was lifted by ½ c. to 13 c. per lb. East St. Louis on January 2. After the U.S. Office of Price Stabilization removed price control on February 13, the market price receded to 11 c. per lb. East St. Louis. In September the price dropped again to 10 c. East St. Louis.

Supply and Demand

Retained imports into the U.K. in 1953 were 80,000 tons of zinc in concentrates and 126,300 tons of slab zinc (down 102,000 tons from 1952). Production of refined zinc was 72,700 tons (up 1,000 tons over 1952). Total consumption was 269,200 tons (up 13,500 tons) of which 76,100 tons are from secondary and the remainder primary.

In the United States several producers curtailed operations because of reduced prices, and mine production was down by 105,000 tons to 485,000 tons. However, refined metal production at 867,000 tons was a trifle higher than in 1952. Imports reached an all-time peak: 470,000 tons of zinc in concentrates and 205,000 tons of slab zinc (double 1952). Although consumption continued at a high level (about 890,000 tons primary metal), the available zinc gave a large margin over requirements, and stocks considerably increased. Latterly production of slab zinc has been reduced and U.S. zinc has been offered in the U.K. and elsewhere in an attempt to relieve the position.

The low price and drop in production of zinc was perhaps of even greater concern to U.S. producers than was the case for lead, and agitation for some form of assistance by tariff protection and import quotas has gone hand in hand for both metals.

In Western Europe consumption appears to have been maintained at a good level but requirements throughout the year were amply covered by available metal. With the fall in price of zinc, some Australian producers were netting less than £A5 a ton f.o.b. Australian ports for zinc concentrates.

The Outlook

The history of zinc during the last three years has provided some salutary lessons. With the demand created by the Korean War a fictitious idea of the growth of world requirements developed. An almost hysterical demand in 1950-51, and fantastic prices led to the encouragement of production expansion programmes, and the development of marginal and submarginal zinc properties. We have returned to a more normal outlook. Although consumption is at a somewhat higher level than before 1950, capacity for production has greatly increased. Some zinc producers must fade out for a while. The position might have been worse, but with the fall in price, zinc recently seems to have regained some of the ground which it had been losing to other metals, particularly to aluminium.

With the greater post-war development of substitution alloys, zinc is more liable to variations in demand and price than is lead. Even so, the prices are unlikely to drop below £70 a ton for any lengthy period. Provided the price holds between £70 and £90, consumption should be maintained at least at present levels in the near future. The problem is—where is the cut in production to fall?

It has been suggested that the problems of zinc and tin are similar. But tin producers are almost exclusively in underdeveloped areas, largely dependent on tin production, and with no available means of assistance such as by import tariffs. The highest cost section of the world's zinc producers is in the U.S.A. where nearly half the world's zinc is consumed, and can thus be accorded whatever tariff protection is deemed necessary to maintain what otherwise would be uneconomic production. Any suggestion that the zinc problem could be tackled by a similar Agreement to that for tin, which the U.S. has eschewed, would receive no consideration. The amount of marginal production maintained by present or future U.S. tariffs must eliminate a like amount elsewhere, mainly in the exporting countries Canada, Mexico, Australia, Peru, Belgian Congo and Italy. Nevertheless, concerted action by these producers to maintain price should not be impossible should the need arise.

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The London Metal Exchange

By Our Metal Exchange Correspondent

THE year 1953 was an important one for the London Metal Exchange as it saw the re-opening of the Zinc Market on the first day of the year and the re-opening of the Copper Market on August 5. Thus the four metals dealt in on the Exchange have now been almost completely freed from Government control, the only remnants being the presence of a Government Broker for copper who continues in operation until the end of May, 1954, and various export restrictions which are maintained on strategic grounds. The financial schemes under which the Exchange operates have proved very satisfactory, and have shown that trading through London can be a valuable asset to the country. The one financial disadvantage under which the Market is operating is the reluctance of the authorities in most non-dollar non-sterling countries to permit their nationals to use the futures market for any other purpose than that of buying or selling physical metal.

Tin

The tin price has fluctuated considerably, opening the year at about £950 per ton and later falling sharply to under £600 per ton, from which level there has been a steady improvement. The market has been almost entirely dependent upon the published attitude of the American Government towards suggested methods to deal with the surplus production which exists. The year 1954 should show the future pattern of tin trading over the next few years, as the question of the creation of a Buffer Pool organization will be answered by the middle of the year. In view of the critical situation in South-East Asia it is to be hoped that consuming nations will adopt a sufficiently broad outlook to permit them to agree to pay a somewhat higher price for their metal than pure economics warrant.

Lead and Zinc

The lead and zinc markets have followed parallel courses, both reaching low points in the middle of April, followed by a recovery of some £15 per ton in the case of lead and £8 per ton in the case of zinc, after which prices moved within narrow limits. In general consumer demand has remained at a satisfactory level, and with the cut-backs which have been made on the production side and the continuation of stockpile intakes by various governments there was no real selling pressure throughout the year. Recently the position has once more become unstable owing to uncertainty with regard to the continuation or not of intakes into the U.S. stockpile.

Copper

Dealings in copper opened with the shadow of Chilean stocks overhanging the market, and with the majority of people expecting the price to open and remain well below the then existing level of 30 c. per lb. As so often happens, however, the experts have been proved wrong, and after an initial drop the market has remained firm well into 1954, by which time an appreciable tonnage of the Chilean stocks has been disposed of without disturbing the previous price level. The main reason for the firm undertone was the continued buying throughout the world to replenish consumer stocks which had been allowed to run down to a dangerously low level prior to the opening of the London Metal Exchange and which coincided with a time when it was thought that Chilean copper would have to be sold at almost any price obtainable.

The outstanding feature of the year has been the persistence of a backwardation in all four metals, and it is worth while trying to set down some of the causes for this and to try and see whether this state of affairs may continue for a considerable period of time, or whether there is likely to be a return to the pre-war condition of a contango.

Market conditions pre-war —

Before the war there were stocks in the world which had to be financed by merchants, banks, etc., and as the London Metal Exchange was the residual market for the world, such stocks normally flowed to London and a contango based on the existing money rates was established. With the existence of a contango, producers and stockholders were in the habit of hedging their metal by selling forward and eventually re-purchasing when the physical metal was sold. This meant that at all times there were two-way dealings, the buyers tending to predominate when trade was good and the sellers when trade was bad, and this interplay resulted in active markets which, however, only fluctuated relatively slowly.

— and to-day

To-day the picture is very different, as surplus stocks have been absorbed by the American stockpile, consumers have become used to living from hand-to-mouth, and producers are deterred from hedging owing to the backwardation. In these conditions it is not surprising that a premium has been maintained for nearby metal, and as most producers have built up large cash reserves during the times of government trading they are able to take advantage of this situation by financing metal until actual arrival at consumers' works.

The other big difference between now and pre-war is the fact that the United States have been a nett importer of all the important metals and can therefore be looked upon as the residual buyer. Unlike the Metal Exchange, however, they are reluctant to lower prices when large tonnages of metal are offered owing to the necessity of satisfying high-cost domestic producers, and tend to adopt artificial methods to maintain prices.

The Outlook

It therefore seems probable that for the foreseeable future the London Metal Exchange will continue to function with small stocks, backwardations, and a tendency for fairly violent upward movements corresponding to consumer buying waves followed by relative periods of inactivity and falling prices. This state of affairs can either be reversed by America's ceasing to become the residual market owing to the imposition of import quotas or too high tariffs, or by producers' financial positions becoming less fluid resulting in the necessity for outside organizations to finance their stocks, or by an appreciable increase in industrial activity resulting in manufacturers having long order-books, thus shifting the buying pressure to metal for forward delivery.

Whilst there is no doubt as to the very useful function which the London Metal Exchange is performing for the metal trade in general, it is foolish to assume that normality is represented by pre-war conditions and experiences, and everyone who directly uses the market, or who only makes use of it indirectly through basing purchases and sales on its quotations, must reconsider the functioning of a futures market under present conditions which may continue for a number of years, and must be prepared for further changes which may not necessarily be towards the situation existing prior to 1939.

Aluminium

By SMITH BRACEWELL, B.Sc., A.R.C.S., A.M.I.M.M.

THE salient features of the aluminium industry of the free world during 1953 were: (1) the 20 per cent increase in the output of primary metal, which, for the first time exceeded 2,000,000 l.tons; (2) the considerably increased demand for primary aluminium for civilian purposes in the United States as compared with the apparent slackening demand in the United Kingdom; (3) the resumption of private trading in the metal in the United Kingdom and the abandonment of some restrictions in the United States; (4) the increasing participation of the major copper-producing companies of the United States in the aluminium industry; (5) the increasing substitution of aluminium for both non-ferrous and ferrous metals; (6) the increasing use of natural gas, lignite and coal as sources of power for the generation of the electricity required for smelting aluminium; and (7) the 10 per cent increase in bauxite production to a total of 11,465,000 tons, due mainly to increased output from the new fields in Jamaica and French West Africa and from Malaya.

PRIMARY PRODUCTION

Excluding U.S.S.R. and satellites

(in thousands of long tons)

	1951	1952	1953
U.S.A.	747	837	**1,117**
Canada	399	446	**481**
France	90	104	**110**
W. Germany	73	99	**105**
Norway	51	52	***54**
Italy	49	52	**55**
Japan	36	42	**45**
Austria	26	36	**49**
U.K.	28	28	**31**
Switzerland	27	29	***29**
Other countries	22	25	***26**
Total	1,528	1,750	**2,102**

* Estimated.

(Source: Mineral Resources Division of Colonial Geological Surveys.)

Production

Production of primary aluminium in the U.S. for 1953 rose to 1,117,000 l.tons, a 33 per cent increase. This country was responsible for more than half the free world production and for 46 per cent of total world production. By the end of 1952 primary aluminium productive capacity had been increased to 1,323,600 tonnes, operated by the three producers, Alcoa (665,400 tonnes), Reynolds (348,000 tonnes), and Kaiser (310,200 tonnes). This has been further augmented by an additional 100,000 tons capacity at the Kaiser plant at Chalmette, Louisiana; an additional 5,000 tons capacity at the Reynolds Corpus Christi plant, Texas; and by the completion early in 1954 by Reynolds of a new 50,000 ton smelter at Arkadelphia, Arkansas. The Anaconda Aluminium Company's new plant at Columbia Falls, Montana, is expected to be in production by the end of 1954 and to reach its full capacity output of 52,000 s.tons in 1955. It is reported that the Harvey Machine Company has reached an agreement with the G.S.A. for the construction of its new plant in Oregon. Olin Industries and the Wheland Company are also considering setting up primary production plants.

Canadian production during 1953 increased by nearly 10 per cent to 481,000 l.tons, or to almost the full capacity of Alcan's four smelters in Quebec. During 1954 the company's total productive capacity in Canada is expected to be increased to 573,000 l.tons by the completion of the initial stage of the Kitimat-Kemano project in British Columbia.

Production of primary aluminium in Western Europe increased during 1953 by about 6.5 per cent. Output in Western Germany and Austria increased by 6 and 33 per cent respectively. In Austria the formerly German-owned Ranshofen plant, which is now State-owned, has not yet been able to operate at full capacity, but is expected to be producing at the rate of 35,000 tonnes per year by the end of 1953. In Yugoslavia, government development plans had included a target of 22,500 tons of crude aluminium per year by 1954; this depended upon the completion of the smelting plant at Strnisce in Slovenia. Completion of this plant has been delayed by the lack of the necessary finance for equipment.

The production of primary aluminium in France increased by about 6 per cent to a new peak of 110,330 l.tons. Owing to the country's limited water-power resources there is little room for expansion of domestic production. For this reason the two producing companies, Pechiney and Ugine, have set up a joint organization, the "Société Africaine de Recherches et d' Etude pour l'Aluminium," to investigate the possibility of establishing a 100,000 ton aluminium plant in French Guinea and a 40,000 ton plant in the Cameroons.

Japanese aluminium production is only about 40 per cent of the peak war-time figure (for Japan proper) of 107,794 l.tons in 1944. During 1953 Alcan agreed to buy 50 per cent of the stock of the Japan Light Metals Co. at a premium and to provide financial, technological and other assistance for the development of the industry. Bauxite will be supplied from the Canadian company's concessions in Malaya and India.

In India the Indian Aluminium Co., a subsidiary of Aluminium Limited, is expanding the capacity of its smelter at Alpuram, Travancore, and is considering the possibility of installing a 10,000 ton smelter near the Hirakud project.

The Reynolds concern is proposing to set up a rolling mill in the Philippines and possibly to supplement this, later, with an aluminium reduction plant.

Production continued on a small scale at Saramenha, near Ouro Preto, in Brazil, by the Aluminio da Brazil, S.A., a subsidiary of Aluminium Limited. Output may be expanded to 10,000 tons by 1954. Production of aluminium in Argentina is contemplated in that country's new five-year plan.

In Tasmania construction of the combined alumina and aluminium reduction plant was commenced in 1950 and is still proceeding. It is expected to start operation during 1954, with an initial output of 13,000 tons of metal per year. Electric power will be obtained from the Hydro-electric Commission of Tasmania. The plant will be jointly owned by the Australian Commonwealth and the Tasmanian State Governments. Extensive deposits of bauxite totalling nearly 10,000,000 l.tons have recently been proved to exist in Arnhem Land in the Northern Territory.

Commander Robert Jackson, appointed by the Gold Coast Government as Special Commissioner to examine in greater detail the problems involved in the implementation of the Volta River Aluminium Scheme, has expressed the view that work on the Scheme could not begin before 1955. The two aluminium companies concerned have not finally committed themselves to this project.

Consumption

The United States provides the world's largest market for aluminium. Shipments of the metal in the U.S. during 1953 amounted to 1,750,000 s.tons, an increase of 34 per cent on the 1952 figure. To meet this demand 260,000 l.tons of primary metal were imported and 223,000 l.tons of secondary metal were recovered, in addition to the 1,117,000

l.tons of domestic primary metal, resulting in a total available supply of 1,600,000 l.tons. About 75 per cent of the imported metal came from Canada and the remainder from Germany, Austria, Norway, and France.

In the United Kingdom the total supply of new metal available decreased from 358,591 l.tons in 1952 to 299,723 l.tons in 1953. This was made up of 30,916 tons of domestic primary aluminium, 178,808 tons of imported aluminium and aluminium alloys, and 89,999 tons of secondary metal. The slackening demand for aluminium in the U.K. has been attributed partly to competition by copper and steel, supplies of which became more easily available; it may, however, be an indication of a contraction of the export market for British aluminium goods caused by increased foreign competition or by restriction of imports abroad.

It has been estimated that aluminium production capacity in the free world at the beginning of 1953 was 2,215,000 l.tons, and that by 1956 this will have been increased to 2,863,000 l.tons. Principals of leading producing companies have recently expressed their confidence that the expanding market will be able to absorb production on this scale. It is anticipated that aluminium and its alloys are likely to continue to replace other non-ferrous and ferrous metals in numerous fields, more particularly in civil engineering and building construction, and in the transportation, electrical, packaging and container industries.

Relaxation of Controls

Private trading in aluminium was resumed in the U.K. on July 1, 1953. In view of existing contracts the Ministry of Materials undertook to purchase surplus aluminium not taken up by private industry for the period covered by the contracts. It was agreed that on the restoration of private trading on July 1 the price should be reduced so as not to exceed £155 per l.ton, but with a view to encouraging the use of the metal the producers immediately reduced the price to £150. Owing to the appreciation of the Canadian dollar and other factors Aluminium Union (the selling organization of the Canadian producers) raised the price to £156 on January 1, 1954.

In the U.S. the C.M.P. system of allocations and controls, which had been re-imposed during the Korean conflict, was terminated on July 1, 1953, and a simpler Defence Materials System was substituted. Under this, certain amounts of aluminium are "set aside" for military and atomic energy requirements each quarter and the remainder is available for civilian purposes.

Bauxite

The production of bauxite in the free world during 1953 was estimated to total 11,465,000 l.tons, an increase of 10 per cent over the 1952 figure. Surinam, British Guiana, the United States, Jamaica and France were the chief producers. The greatest increase (of 922,000 l.tons) was in Jamaica, where production by the two United States and one Canadian companies commenced only in 1952. The Canadian subsidiary, Alumina Jamaica Ltd., exports alumina, whilst the two U.S. companies export crude washed and dried ore.

Production in French West Africa, which also started in 1952, reached 320,000 l.tons in 1953. Malayan output of bauxite also increased by 130,000 tons.

Extensive deposits of commercial bauxite have been proved to exist in the Northern Territory of Australia. Deposits of possible economic importance have recently been found in Sierra Leone and these are being investigated by the British Aluminium Company Ltd. Further discoveries of the ore are reported from the Good Hope area of Jamaica. Investigation of the deposits in British North Borneo has been abandoned. The Reynolds Corporation is commencing development of the deposits in Haiti.

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Magnesium

THE critical shortage of magnesium for defence requirements led to an 87 per cent increase in world production between 1951 and 1952. This expansion was followed by an easing of defence demands and proved to be excessive. By June, 1953, stocks in the U.S. were sufficient to justify the closing down of five of the six government plants. Primary production of magnesium in the U.S. amounted last year to 93,075 tons, which was 12 per cent lower than the output in 1952. Preliminary reports indicated that consumption was 15 per cent below that of 1952. The only U.S. plants still in production are one of 40,000 tons annual capacity at Velasco, Texas, which is government owned, and the Dow Chemical Co.'s plant at Freeport, Texas, which produces about 29,000 tons annually.

Production Outside the States

Canadian output figures are not published, but it is known that the production of magnesium by Dominion Magnesium Ltd. exceeded the previous high record of 1952. In recent years Norway has again become prominent as a supplier of magnesium and by the end of 1952 Norsk Hydro-Elektrisk Kvaelstof AS of Oslo had an annual capacity of 5,000 tons of metal, which could be doubled.

The United Kingdom had been manufacturing and importing rather more than its present requirements of about 4,000 tons of magnesium a year, the excess being used to improve the stock position. Supplies are now such that the requirements can be met by normal trading. On January 1, 1954, the Ministry of Materials ceased to trade in magnesium and the Magnesium Distribution Order, 1951, was revoked. Private importation is again permitted.

The meteoric rise of the magnesium industry has been due mainly to the expansion of aircraft production. Because of their outstanding weight-strength ratio the new magnesium-zirconium alloys are finding expanding markets, especially in the aircraft industry for heavy duty castings. Several British aircraft, including the Comet and most of the latest types of jet engines and turbo jets, contain castings made of these new alloys. An all-magnesium car body was shown at the first International Magnesium Exposition held at Washington in March, 1953. A U.S. company is planning the production of all-magnesium trailer-type truck bodies with a substantial saving of weight on similar bodies made of aluminium and still more over steel truck bodies, the respective weights being 850 lb., 1,300 lb., and 2,200 lb.

Cheap Electric Power the Key

Unless British plants are again assisted by the provision of electricity at favourable rates, cheap electric power will probably give Canada, the U.S. and Norway a permanent advantage in the production of magnesium metal. Producers in North America and Europe are likely to have surpluses this year and consequently price will be the governing factor. Dominion Magnesium, it has been reported, proposes to market magnesium ingot in the U.K. at 34 c. c.i.f. U.K., equivalent to less than 2s. 6d. per lb. Increased availability and lower prices will stimulate usage, and in the long run increased production seems assured.

Magnesite

The production of magnesite in the U.S. decreased by 24 per cent in 1952 to 463,342 tonnes, but world production remained practically unchanged at 3,800,000 tonnes. Austrian production of crude magnesite reached a new peak of 792,000 tons last year, compared with 741,000 tons in 1952. Production by Greece is also being steadily expanded. These countries, with India, are the principal suppliers.

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Titanium

By A. GRAHAM THOMSON

THOUGH it was only in 1948 that metallic titanium was first produced commercially, the strategic importance of this metal is becoming so great that the U.S. Government has been severely criticized for its failure to get the titanium programme moving more rapidly.

To-day, jet engines of 10,000 lb thrust are in operation, but engines of 20,000 lb. thrust are not far away. The designer of such aircraft must have a corrosion-resistant metal of light weight and very high strength, capable of maintaining that strength at high temperatures. Only titanium alloys offer this combination of properties, and the speed with which advanced aircraft move into production depends on expansion of the titanium industry.

U.S. Production in 1953

In 1953 the U.S. produced 2,241 s.tons of commercial titanium sponge, thus more than doubling the 1952 output of 1,075 tons. Production was still confined to E. I. du Pont de Nemours and Co., Newport, Delaware, the Henderson, Nevada, plant of the Titanium Metals Corporation of America, and the U.S. Bureau of Mines pilot plant at Boulder City, Nevada. Last year, however, D.M.P.A., contracted with Cramet Inc. for a 6,000 ton per year facility costing some $25,000,000. Full production is expected by 1956. This production, together with the quantities to be made available by the Titanium Metals Corporation and du Pont under existing contracts, assures only a total of some 13,200 tons in 1956. This falls far short of target levels.

Earlier estimates of defence requirements (35,000 s.tons subsequently reduced to 22,000 s.tons) are now described as unrealistic in view of the new types of aircraft being designed and the speeds of up to 3,000 m.p.h. now visualized. R. P. Hurley, chairman of the Curtiss Wright Aircraft Corporation Board, has said that for leadership in the air the U.S. must have titanium, and he has indicated that his company intends to set up facilities for the production of titanium metal at Buffalo. With assurance of support by key government officials, the target has been raised from 25,000 s.tons annually to 37,500 s.tons in 1956. Senator Malone has put the eventual consumption, if the metal was available at reasonable cost, at not less than 150,000 s.tons annually. The General Services Administration recently announced an agreement with du Pont to begin design and engineering studies looking towards the erection of a plant with an annual capacity of 7,000-8,000 s.tons. It is understood that other firms are to receive contracts in the near future.

A programme for the expansion of melting and fabricating facilities at Midland, Penn., was announced in October, 1953, by Rem-Cru Titanium Inc. It was planned to increase melting and fabricating capacity 300 per cent to 10 ingot-tons of metal per day during the first half of 1954.

Titanium Sponge Production in the U.K.

In August, 1953, it was announced that Imperial Chemical Industries were to build new plants in Britain for producing 1,500 tons of sponge titanium a year and for converting the metal into ingot form. This new capacity, the cost of which will be borne entirely by the company, is expected to be in production before the end of 1955. It is additional to pilot plants built by the same company to produce 150 tons of sponge titanium a year, which were scheduled for production early in 1954. I.C.I.'s plans for the new plant are believed to be based on a new and more efficient process than has hitherto been used.

The Ministry of Materials has undertaken to buy directly up to 75 per cent of I.C.I.'s output of sponge titanium over the first four years of production, if the metal is not otherwise sold in various forms for use by government contractors. The Ministry also has an option on the full output if needed for defence purposes. The price of the metal will be equivalent to the world price at the time of purchase.

Progress in Japan

The only other country producing titanium sponge is Japan, which has been subsidizing production in various ways. Although titanium products from the experimental plants had previously been exported to the U.S., 1953 was the target year for the full industrialization of the metal. Output for the fiscal year which began on April 1, 1953, was estimated at 160 tonnes. This total includes production from the Osaka Titanium Company's new $1,500,000 plant which was to be completed in the latter part of 1953 with a capacity of 50 tons of titanium per month, the Japan Electric Metallurgical Company, the Nippon Soda Company, and the Mitsui Metal Mining Company.

Research and Development

Research and development also made rapid progress in 1953. The first industrial laboratory in the U.S. to be devoted exclusively to titanium was opened at Niles, Ohio, by the Mallory-Sharon Titanium Corporation. The same company has announced the development of a new melting process by which, it is claimed, homogeneous ingots are produced, carbon content can be controlled and held as low as the quantity inherent in the sponge, and more metallic titanium can be produced from a given amount of sponge. A technique for re-melting titanium scrap was announced by Allegheny Ludlum and during last year a significant volume of re-melt metal was sold to regular commercial specifications.

In the United Kingdom the British Non-Ferrous Metals Association is making a rapid survey of the mechanical properties of various titanium alloys, to be followed by a more detailed study of promising alloy types. The Metallurgy Division of the National Physical Laboratory has worked out the conditions under which titanium may be produced directly from titanium oxide, and titanium that is workable when hot has been produced.

Problem of Price and Supply

Hitherto the U.S. production has been fully absorbed by government contracts. In March, 1954, however, an advisory committee recommended that a percentage of titanium mill products be set aside for industrial use to encourage a civilian market for the metal. Price would, of course, be a limiting factor at this stage, but it is noteworthy that Titanium Metals Corporation recently announced price reductions averaging 12 per cent for pure metal sheet and plate. This is the first significant cut and reflects rapidly expanding output and improved manufacturing techniques. Rem-Cru's latest price schedule includes cuts up to 14 per cent in a number of its processed products. This is the third cut which this company has made. These developments encourage the hope that commercial usage may not be long delayed.

Strategic Considerations

Although ore supplies present no immediate problem, it is being urged in some quarters that the U.S. should rely exclusively on domestic and/or Canadian ores for its defence requirements. Opponents of this school of thought contend that as long as Canadian, Australian and Indian ores are economical, there should be some importation. Canadian Government experts believe that the deposits of eastern Quebec may rival Labrador iron and Prairie oil in importance.

Iron and Steel

By J. H. THOMPSON

PRECISE statistics of world steel outputs in 1953 are not yet available, but according to the carefully compiled statistics of the British Iron and Steel Federation the total world output of crude steel last year was about 230,400,000 tons compared with 207,840,000 tons in 1952. To this total the countries of the " free world " contributed approximately 181,200,000 tons while the total output of the countries behind the " iron curtain " was about 49,200,000 tons.

U.S.A. Makes New Records

Of the free world output well over 50 per cent was provided by the United States which produced 99,650,000 tons, a gain of 16,470,000 tons over the 1952 total. This spectacular rate of expansion across the Atlantic, equalled in no other country, is of course largely accounted for by the fact that American production in 1952 was severely restricted by the 54-day strike, whereas operations in the succeeding year were unimpeded by any serious stoppages.

Increase of steel production in the Eastern *bloc* from 44,420,000 tons in 1952 to over 49,000,000 tons last year represents a rise of 10½ per cent, a rate of progress equalled by no European country this side of the iron curtain. Nevertheless the preponderance of production in the free world over the Eastern *bloc* was nearly four to one, and with a record ingot output of 17,609,000 tons the U.K. easily established its supremacy as the biggest steel producer in Western Europe.

WORLD CRUDE STEEL OUTPUT
(million tons)

	1937-8 Average	1952	1953
U.S.A.	39.46	83.18	**99.65**
United Kingdom	11.68	16.42	**17.61**
Western Germany	18.49	15.56	**15.18**
France	6.96	10.70	**9.84**
Belgium	3.02	4.99	**4.43**
Luxembourg	1.94	2.95	**2.62**
Italy	2.17	3.48	**3.44**
Saar	2.41	2.78	**2.64**
Netherlands	0.05	0.67	**0.86**
Other W. European Countries	2.38	4.79	**5.18**
U.S.S.R.	17.62	33.95	**37.30**
Czechoslovakia	2.03	3.52	**4.08**
Poland	1.48	3.13	**3.50**
Eastern Germany	—	2.02	**2.05**
Hungary	0.65	1.11	**1.48**
Roumania	0.26	0.69	**0.78**
Southern Rhodesia	—	0.04	**0.04**
Canada	1.28	3.31	**3.67**
India	0.92	1.58	**1.47**
Australia	1.14	1.55	**1.82**
South Africa	0.33	1.18	**1.22**
Latin America	0.15	1.87	**2.04**
Japan	6.04	6.88	**7.53**
Other Countries	0.54	1.49	**1.97**
World Total	121.00	*207.84	***230.40**

* Estimated.

The Newer Producers

It is interesting to observe that whereas the decline in the demand for steel in the countries of the European Coal and Steel Community was severe enough to reduce production by five per cent last year, the newer producing countries in the Commonwealth and Latin America continue to extend their steel interests. Cut off from their traditional sources of supply during the war period, they have persistently pursued a policy of expansion with the result that the Commonwealth countries produced 8,220,000 tons in 1953 compared with a pre-war output of 3,670,000 tons, whilst steel output in the Latin American Republics has achieved an even more spectacular increase, rising in the same period from 15,000 to over 2,000,000 tons.

British Achievements

Chief effect of the expansion of British steel production has been that it has not only overcome the shortage of supplies which in earlier years proved such a grave embarrassment to the heavy industries, but has also made possible an increase of 140,000 tons in the volume of exports and a shrinkage of foreign ingots and semi-finished steel from 1,820,000 to 1,100,000 tons.

The post-war investment of over £250,000,000 upon capital re-equipment has been rewarded not only by an increase in capacity which, at the end of last year, had reached nearly 19,000,000 tons, but also by very substantial economies in the cost of production.

The installation of new ore handling plants has quickened the turn round of the ore carriers thereby reducing ore transport costs; improved techniques and bigger blast furnaces have resulted in valuable fuel economies, and a comparison of current British, European and American prices affords ample justification for the recent pronouncement of Sir Ellis Hunter, the former president of the British Iron and Steel Federation, that " the British steel industry has no cause to fear normal competition from the Continent."

This comment does not imply a mood of complacency. Having completed the first post-war development plan the British steel industry, with the consent and active co-operation of the Treasury, has already embarked upon a still more ambitious programme of development which at an estimated cost of a further £300,000,000 is designed to provide a total supply of 21,000,000 tons per annum by 1957-58.

The risk of redundancy cannot be ignored. Over expansion carries with it heavy financial penalties, and the Federation's most recent analysis of the position makes a flexible import programme the key to the handling of peak demands. But at the time of greatest need, as past experience has proved, bigger imports are usually more difficult to arrange, and it is significant that the Treasury view supporting that of the Federation is that the British steel industry should aspire to a greater measure of self-sufficiency.

The European Community

In this context the relationships between British steel and the High Authority of the European Coal and Steel Community are invested with considerable importance. More than a year has now elapsed since a common market was established in the six member States of the pool, for coal, iron, ore and scrap, and nearly 12 months since steel was also included. Thus over an area four times the size of Britain there has been free movement of coal, ore, scrap, iron and steel irrespective of international frontiers. Customs duties have been abolished and there has been free access to Ruhr coal and the iron ores of Lorraine.

On the whole the new alliance has withstood the testing period of a slack market fairly well. But that there have been serious teething troubles is undeniable. It is admitted, for example, that steel has been sold at well below the price schedules fixed by the High Authority, which is now confronted with the difficult problem of enforcing observance of its price regulations on a declining market.

As a new organization laying claim to new loyalties which at times cut directly across individual or national interests, the High Authority is entitled to a reasonable period of time in which to make its will effective. But the position is such as to justify the hesitations of the British steel industry in accepting the invitation to enter into closer working arrangements. The view of the British Federation was

aptly summarized by Sir Ellis Hunter in a recent article in the *National Provincial Bank Review*, when he said :

"The common market has been in existence for too short a time . . . and is working in too uncertain a manner to permit of any firm judgment on the likely effects of any British association with the Community. . . . This background of uncertainty would seem to be an unhappy concomitant to the proposals for an agreement with Britain It would require a decision on insecure data."

The aspiration for some form of alliance has not been abandoned. On the contrary, M. Monnet, the president of the High Authority, has more explicitly defined his objective which he says is " not a commercial agreement or a division of markets, but common action, common responsibilities, and obligations shared on a basis of equality."

Whilst these matters are being discussed behind closed doors, the proposal of American aid for the Pool in the form of a substantial development loan has become the subject of active negotiation. The State Department is believed to be sympathetic. The need for the modernization of plant which is well below the standard of efficiency in this country is clearly recognized and it may be recalled that President Eisenhower himself has publicly stated that dollars to back up the Community or its agencies " would foster European integration in a tangible and useful way."

Raw Materials for British Steel

One of the major problems posed by the world wide expansion of steel production is the provision of the enormous tonnages of raw materials consumed in the blast furnaces and moulding shops. It is useless to provide new plant without first consolidating and expanding the supply of ore, coke and scrap. Deficiencies in coking capacity are being rapidly overcome and sufficient progress has been made in the blending of coals for the ovens as to encourage the hope that quantities of fuel hitherto deemed unsuitable or undesirable may be converted into blast furnace coke.

The ever ascending price of coal (and the cost of transport) has, however, intensified industrial interest in the quest for fuel economies. It has also given a further impetus to the development of new sources of foreign ore, with a higher iron content than home ore, and a consequential reduction in coke consumption.

In this direction, very considerable progress has been achieved. British imports of iron and manganese ores last year totalled 11,357,000 tons which is 1,390,000 tons above the previous highest total of 9,967,000 tons in 1952. Sweden, our biggest source of supply, is increasing its ore production and long term contracts with Newfoundland have also been arranged. Resources in the Mauretania orefields in the Sahara are in process of exploitation, while the new orefield at Conakry on the west coast of Africa has already been brought into production. A very much greater project for the development of ore supplies is also afoot in Quebec, Labrador, but supplies from this source will chiefly benefit Americans and Canadian steel makers who are also shipping big tonnages from Brazil.

As more and bigger blast furnaces come into operation the British steel industry will require still larger tonnages of imported ores and the provision of facilities for the transport and handling of these enormous tonnages at a minimum cost becomes a matter of the highest importance.

Traditionally ore cargoes for Britain have been transported in ocean going tramps, but the numbers of these available are steadily diminishing, and taking time by the forelock the steel industry, in collaboration with shipping interests, has embarked upon a project for the building of a fleet of 15 ships specially designed as ore carriers with capacities ranging up to 14,000 tons.

U.K. STEEL'S RECORD YEAR

	1952 *Tons*	1953 *Tons*
Pig iron production	10,728,000	*11,175,000
Steel production ...	16,418,000	*17,609,000
Iron and steel imports	2,640,000	1,719,500
Iron and steel exports	2,498,700	2,639,300
Ore imports	9,697,600	*11,357,000
Home ore production	15,927,600	15,818,000

* All-time records.

End of the Shortages

A notable feature of the past year's operations has been the almost complete conquest of the steel shortage. Sooner or later it was bound to happen that the prodigious aggregate of world output would overtake the demand, and although the change on the markets has been more apparent overseas than in this country, the only categories of steel products for which the requirements of British consumers still exceed the current output are flat rolled products such as plates and black and galvanized sheets. American steel furnaces and rolling mills are operating well below rated capacity and although in the Schuman countries there has been some recovery from the recession between May and September of last year, the steady decline in prices bespeaks the reversion to a buyers' market for steel.

The reductions in British export prices forced upon the steel industry by growing competition abroad and bringing prices more into line with international and particularly Continental levels, still leave substantial premiums over domestic levels which may be further reduced or cancelled out entirely if the need arises. But at present British prices are fully competitive and the limited expansion of the volume of exports last year may be ascribed chiefly to the multifarious restrictions upon imports and other restraints upon international trade which have been so generally imposed as a means of adjusting the trade balances. There has recently developed a clearer concept of the need for liberalization of international trade.

The Outlook

By and large it can be affirmed with a considerable measure of confidence that the British iron and steel industry is well equipped to meet any demands which may be made upon it : adequate arrangements have been entered into for that steady and continuous flow of the raw materials which are essential to maintain production at peak levels, and it is still true to say, as Sir Lincoln Evans, vice-chairman of the Iron and Steel Board, said a year ago, that " no industry has within the limits of its ability, a better record than the iron and steel industry, in responding to the necessity of helping on the road to national recovery."

To the advances made in the recruitment of bright young men and their technical training, the prosecution of scientific research upon an unprecedented scale, and the progress which has been made in the denationalization of the industry, adequate reference is forbidden by the limitations of space. Suffice it to say that the Iron and Steel Holding and Realization Agency under the chairmanship of Sir Archibald Forbes has only just begun the task of transferring back to private ownership the whole of the assets and securities of the nationalized section of the industry.

At the time of writing only two of the big steel companies' holdings have been publicly issued and in both cases the shares were subsequently quoted at a discount. Both transactions yielded a profit to the State, but both involved the buyers in immediate capital losses. Perhaps it is too soon to jump to definite conclusions, buf the terms of " Ishra's " next offer will certainly be carefully scrutinized, and it may well be that the final liquidation of the assets of State Steel may still be far distant.

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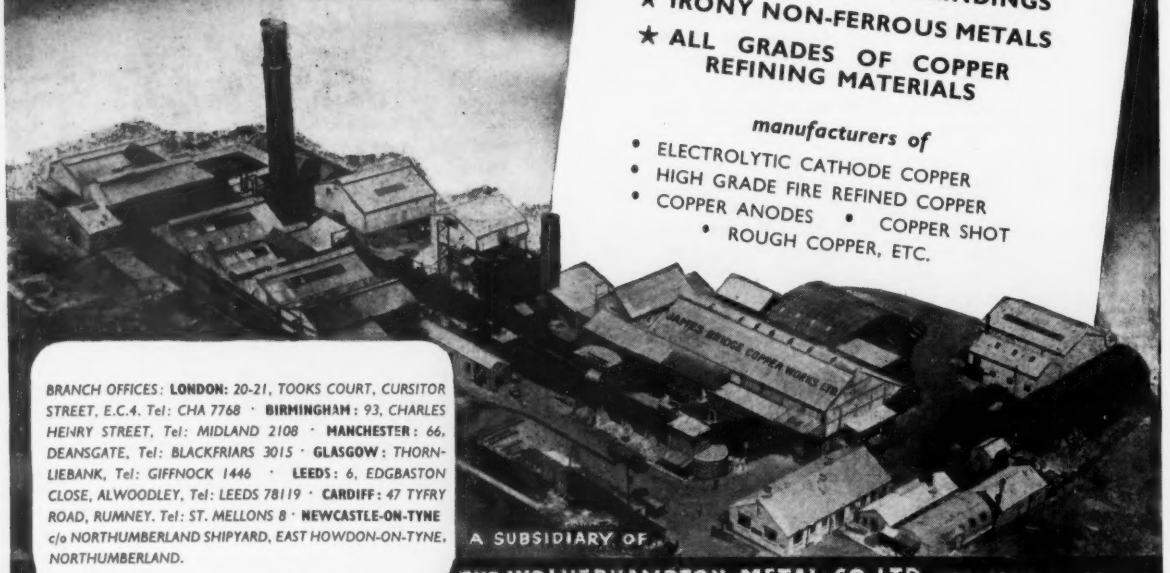

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Manganese

MANGANESE is used to de-oxidize and de-sulphurize iron and steel and also as an alloying agent in the production of "soft" low carbon steels. Half the total world output is produced in the U.S.S.R., the other principal producers being India, the Gold Coast and South Africa in that order. The leading free world steel producers are all large importers and consumers of manganese ore.

Last year the consumption of manganese ore reached a new high level. In the U.S. it amounted to an estimated 2,300,000 s.tons, compared with 1,809,000 tons in 1952. Imports rose from 2,669,000 tons to 3,500,000 tons. As in 1952 three-quarters of the shipments to the U.S. came from India, Gold Coast, South Africa and Cuba.

Expanding Production

Throughout the free world efforts have been made to expand supplies. South Africa produced a total of 912,339 tons (all grades) last year. Gold Coast exports totalled 745,990 tons (794,192 tons in 1952). The Indian Bureau of Mines has undertaken experiments on the beneficiation of low-grade manganese ore from Madhya Pradesh. Low-grade ores from Katchindana mines were taken up for study. A heavy media separation plant was being installed by the Central Province Manganese Ore Co. Ltd. at its Dongri Buzurg mines for the beneficiation of low-grade ore.

The Congo's production has been steadily increased, reaching 202,445 tonnes in 1953 against 127,978 tonnes in the previous year and 70,945 tonnes in 1951. A contract has been concluded between the U.S. Steel Corporation and the State of Mato Grosso, Brazil, under which the Corporation will operate mines at Urucum, near Corumba, for 50 years with a possibility of extension. The concessionaire must produce a minimum of 50,000 tons of manganese ore yearly. A sintering plant is planned by General Base Metals Inc., the largest post-war manganese producer in the Philippines. Manganese occurrences are under investigation in British Guiana and elsewhere. A new company, Canadian Manganese Mining Corporation, has been formed by New Delhi Mines Company to investigate a large deposit discovered near Bathurst, New Brunswick. A 5-10,000 ton a day concentration plant is planned.

The Position in the States

The effects of expanding production were manifest in June, 1953, when allocation of manganese ore was virtually suspended by the D.M.P.A., who stated that supplies and requirements were almost in balance. It is estimated that provision has been made for annual supplies to the U.S. of some 2,846,000 tons by 1955, with higher to follow.

The U.S. domestic production rose sharply from 116,300 tons in 1952 to 160,000 tons last year. Another significant development was the resumption of Russian exports under the current Franco-Soviet trade agreement, followed by the first shipment of ore to Britain since before World War II. Also noteworthy was an announcement by the American Iron and Steel Institute that U.S. dependence on imported manganese for making steel will be sharply reduced if a new process for recovering it from open hearth slag is successful. The Institute considers that if the method proves economically feasible, as much as half the U.S. steel industry's manganese needs may eventually be recovered from open hearth slag. A slight decrease in industrial consumption was anticipated for 1954.

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Nickel

By A. GRAHAM THOMSON

THE year 1953 saw the end of international nickel allocations and the easing of restrictions on civil usage in the main consuming countries. The International Materials Conference announced in August that it would be unnecessary to allocate nickel among non-Communist countries in the fourth quarter of the year. On October 31, member countries of O.E.E.C. were released from their common decision to restrict the use of this metal. In the United Kingdom all restrictions on the use of nickel were removed with effect from November 6. The U.S. Office of Defense Mobilization lifted controls on November 1 on civilian use of the metal and the Canadian Government ended its two-year control over nickel sales.

Civilian Supplies Still Tight

The lifting of restrictions has not brought plentiful supplies and certain European consumers, notably Western Germany and Italy, are still experiencing shortages. In the opinion of Dr. J. F. Thompson, chairman of the International Nickel Company, it will be many months before adequate supplies are available for civilian purposes. Nickel is the foremost armament material and almost half of the free world's production of the metal in 1953 was allocated for military, atomic and stockpile requirements. Over 65 per cent of this year's output has gone to the U.S., and the proportion is expected to increase under the contract concluded in June, 1953, by Inco and the U.S. defence procurement authorities for the supply, over a five-year period, of 60,000 tons of metallic nickel beginning in January, 1954.

Dr. Thompson anticipates that the world output of nickel will reach 197,500 s.tons this year, or 22,500 tons more than that for 1953, which was 25 per cent above the 1949 or pre-Korean level. He has predicted that by 1960 the world's productive capacity, based on announced expansion programmes, will be 75 per cent greater than in 1949.

International Nickel's Predominant Role

Last year the U.S. Office of Defense Mobilization announced an expanded nickel procurement programme calling for an additional 190,000 s.tons per annum. It is expected that 152,000 tons of this planned increase in annual production will be available by 1956. Inco's contract is by far the largest of those signed by D.M.P.A., and was made possible by the completion last year of certain mining and metallurgical developments, resulting from years of planning and research by the company.

The company's total productive capacity has already been raised by 12,000 s.tons a year to meet the U.S. Government's added demand and is now 137,500 tons annually. In 1953 Inco produced from underground and surface combined a total of 13,667,095 tons of ore compared with 13,248,593 tons in 1952—yet another record. Inco is continually searching for new orebodies.

A contract between D.M.P.A. and Falconbridge Nickel calls for production and sale to the U.S. of a minimum of 50,000 s.tons of nickel by the middle of 1962 and a possible additional 50,000 s.tons by mid-1967. D.M.P.A. also has contracts with the Hanna Coal and Ore Corporation and the Hanna Nickel Smelting Co., subsidiaries of the M. A. Hanna Company, of Cleveland, Ohio, for the production of 47,500-62,500 s.tons of ferro-nickel from a deposit in southwest Oregon, the only major known nickel deposit in the Continental United States. Another U.S. company, Western Nickel, has contracted to supply 21,000 s.tons of refined nickel, production being scheduled to begin in 1955.

The Canadian production amounted last year to 143,915 tons, and represented about 85 per cent of the total free world output. It rose to a still higher level towards the end of the year, when Sherritt Gordon began to produce from its Lynn Lake property at the rate of some 8,500 tons yearly. This company's refinery at Fort Saskatechwan, Alberta, which will produce nickel and cobalt metal powders as well as ammonium sulphate, is the culmination of research involving Sherritt Gordon Mines Ltd. and the Chemical Construction Corporation in four pilot plants over a period of five years. Another new producer is the Nickel Offsets mine in the Sudbury district.

Development Plans at Falconbridge

Falconbridge has started on an $11,500,000 programme to double nickel output from 15,000 to 30,000 tons annually. The programme involves sinking two shafts and mine development up to the production stage at the Fecunis Lake orebody adjoining Inco's Levack mine, 20 miles north of Sudbury. The mine is expected to go into production early in 1958. Falconbridge also acquired land last year at Port Colborne, adjacent to the Welland Ship Canal, on which a nickel refinery will be constructed. The plant will be used for the treatment of concentrates, but will not be built until the treatment processes are more fully developed than at present. Most of Falconbridge's nickel is now refined in Norway. The building of the proposed refinery will concentrate the world's nickel refining at Port Colborne.

The Nicaro plant in Cuba was re-opened by the U.S. Government in 1952. When worked during the war it had a capacity of about 16,000 s.tons of nickel oxide yearly. In August last year the National Lead Company took over the responsibility for the distribution of all production from this plant. Early in 1954 it was announced that this company would carry out an expansion programme to increase the capacity of this U.S.-Cuban Government owned nickel facility by 75 per cent or about 10,500 tons per annum.

The Moa Bay Discovery

The Freeport Sulphur Co., which controls the Nicaro Nickel Company in Cuba, has discovered what is believed to be the largest deposit of nickel anywhere in the free world, outside Canada. It is situated at Moa Bay about 40 miles west of the Nicaro mine. A minimum of 40,000,000 tons of ore is said to be indicated, averaging around 1.35 per cent nickel and .14 per cent cobalt. A new leaching process which makes possible the separate production of cobalt as metal has been devised with the co-operation of Chemical Construction Co., a subsidiary of American Cyanamid. The present estimate is for a minimum output of 15,000 s.tons of nickel and 1,500 tons of cobalt. The U.S. Government has given the Nicaro Nickel Co. a tax write-off allowance on $55,250,000 worth of new nickel and cobalt refining facilities.

The U.S. Bureau of Mines, under an agreement with D.M.P.A., has been drilling in the Levisa Bay district of Cuba. By November, 1953, over 20,000,000 tons of ore with an average grade of about 1.35 per cent nickel and .09 per cent cobalt had been indicated.

Despite rapidly expanding production there is every indication that supplies of nickel coming forward this year will continue to be readily absorbed. With producers contributing to the development of new uses the same energy they have shown in developing new sources, it is considered that profitable use can be found for all available metal.

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Chromium

CHROMITE is the only commercial source of chromium, which is an essential ingredient of all stainless steels and of other high temperature alloys used in the production of jet aircraft and gas turbines.

The high level of demand in 1953 was indicated by an estimated U.S. consumption of 1,334,000 s.tons of all grades of chromite, which was 10 per cent above the figure for the former record year of 1951. Consumption of chrome metallurgical products reached a new high level, 63.5 per cent of these products being consumed in stainless steels.

Turkey

Turkey is now the world's largest exporter of chrome, supplying 39 per cent of the total U.S. imports in 1953, besides shipping substantial tonnages to Britain and Western Europe. Her production of chromite is believed to be currently running at the equivalent of an annual rate of 550,000 l.tons of crude ore. In April, 1954, it was reported that Turkish exports of chromite had ceased, because the government refused to sanction sales under the official prices, which were above world prices.

Southern Africa

Southern Rhodesia's export target for 1953 was 483,000 tons. The railways had intended to move this quantity, but were hampered by delay in the arrival of extra engine power, while the chrome loading facilities at Beira have not yet given the results for which they were designed. The year's production amounted to 463,030 tons valued at £2,927,783 (318,000 tons in 1952). Operation has started in Southern Rhodesia of a new mill for the concentration of alluvial and metallurgical grade chromium ore from properties in the Great Dyke region belonging to the Vanadium Corporation of America.

South Africa, the chief supplier of chemical grade, produced 798,567 tons last year (570,000 tons in 1952).

Other Producers

The Philippines are the largest source of refractory grade chromite and produce lesser amounts of metallurgical grade ore. The output for all grades for January-June, 1953, totalled 267,546 tonnes against 543,514 tonnes for 1952. Pakistan's production amounted to 19,280 tons in January-October, 1953, and again commanded the highest price in the U.S. market. Investigations of chromite deposits in the Singbhum district of Bihar and Keonjar district of Orissa have resulted in the location of 2,120,000 tons of reserves instead of the previously estimated 200,000 tons.

With the entrance of the Mouat Chrome mine in Montana as a producer in August, it was anticipated that the U.S. production last year would exceed 50,000 tons.

A significant event last year was the shipment to American and British steel companies of trial consignments of the first ferrochrome to be made in Africa. It was manufactured by Rhodesian Alloys Ltd. at Gwelo, S. Rhodesia, in a pilot plant with an annual capacity of 5,000 to 7,000 tons. Another important development was the first commercial production of electrolytic chromium in the world's largest ferro alloy plant laid down at Marietta, Ohio, by Electro-Metallurgical Company.

World production of chromite is increasing and with renewed Russian interest in exports, it appears unlikely that there will be any further increase in the price of chrome.

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Tungsten, Molybdenum and Vanadium

THE current year began with tungsten again in plentiful supply, a declining demand, and falling prices. The Ministry of Materials' sales prices, which were 535s. per unit at the outset of State trading on July 30, 1951, fell to 120s. for wolfram and 115s. for scheelite on February 21 this year, more than half the decline occurring after July, 1953. In March and April, however, quotations rose very sharply and by April 27 the Ministry's sale price had advanced to 245s. and 240s. per l.ton respectively.

U.K. Resumes Private Trading in Tungsten

Private trading in tungsten ores and concentrates was restored by the British Government as from April 1, 1954. Private importation from all sources other than the dollar area is now permitted, but to ensure smooth transition from public to private trading, arrangements were made with the trade by which consumers in the early months would still fill a substantial part of their requirements by purchases from the Ministry's stocks.

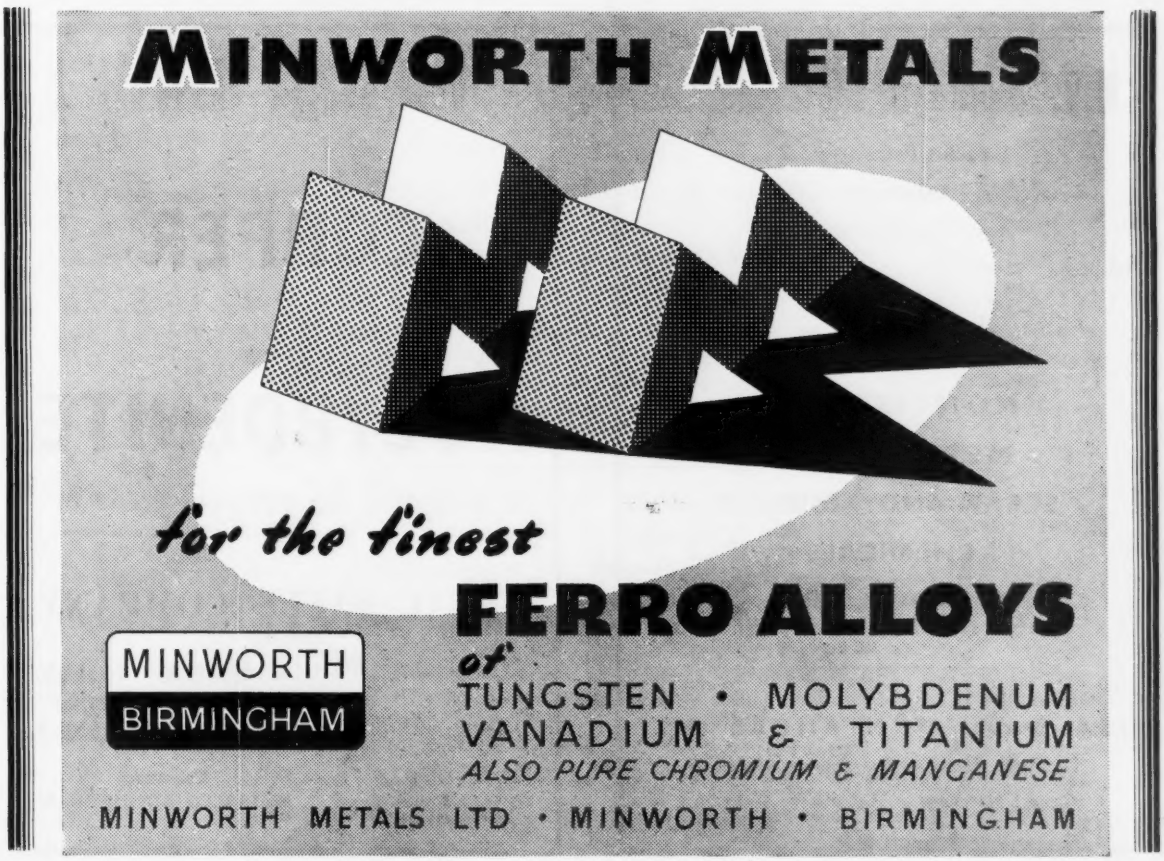
Although it was announced in November, 1953, that tungsten would no longer be purchased from the U.S. stockpile, it is possible that the metal is included in the new stockpiling programme, details of which are not available at the time of going to press. The U.S. House of Representatives has passed and sent to the Senate a Bill to extend for two years the Federal Government's domestic tungsten purchase programme, which was due to terminate on July 1, 1956. The purpose of this Bill was to provide more time for tungsten miners to discover, develop and produce commercially workable orebodies.

The free world production is estimated to have increased from 34,000 tonnes of 60 per cent WO_3 content in 1952 to 42,000 tonnes in 1953. Output is expected to decline during 1954 on account of the lower prices, but many of the larger mines have long-term contracts that call for prices well above those now ruling.

Increases in Production

Under the stimulus of the government purchasing programme U.S. domestic production increased last year by 20 per cent to 4,470 s.tons. Minerals Engineering Co. is building a 300 ton flotation mill to treat ores from its mines at Glen, Montana. Substantially higher outputs are also indicated for Brazil, Canada, Korea, Spain and Thailand. On the other hand, Portuguese exports declined from 4,495 tonnes in 1952 to 3,870 tonnes last year. The position in that country is discussed at greater length on page 181. Spanish exports are now considerably above those of Portugal; this is ascribed partly to the fact that Spain facilitates exports and does not impose penal export duties.

Thailand shipped 880 tons of concentrates to the U.S. in the first ten months of 1953, but the G.S.A. has recommended that the four Thailand contracts to provide the U.S. with some 3,500 units of tungsten concentrates be permanently cancelled owing to irregularities. The U.S. has also refused to renew its purchase contract with South Korea for 15,000 tons of tungsten a year and South Korea is therefore closing down its mines. Australia's production of wolfram and scheelite (65 per cent WO_3) aggregated some 2,000 tons in 1953 against 1,274 tons in the previous year.



Studies of the Turkish Mineral Research and Exploration Institute have established that a new wolfram mine discovered in the mountains near Edremit, in the Marmara region, contains the richest deposits found in the world so far. The wolfram content is 7.51 per cent.

The return to free trading coincided with a slightly more buoyant undertone in the London market. After buying from hand to mouth for a considerable period consumers were reported to be anxious to secure spot metal, but apparently there was practically no tonnage available for early delivery. The sharp rise in price during March and April was attributable largely to increasing concern over the Indo-China situation and to the closing down of the South Korean mines. However, additional supplies are being received from Burma and the possible return of China (by far the world's largest producer with 9,700 tons of WO_3 in 1952) to the world market cannot be excluded.

It may be many years before civilian usage can fill the gap which will be created by declining armament production, but new outlets for tungsten might well be established, and the long-term prospects are by no means discouraging.

Molybdenum

Because of its unusual resistance to high temperatures, molybdenum is taking on special importance for the hardening of steels used in jet engines, which often encounter operating temperatures of 1,700 deg. F. and higher. A successful technique for the electrolytic preparation of this metal has been evolved by Dr. Seymour Senderoff and Dr. Abner Brenner, of the National Bureau of Standards. More rapid and less expensive methods for producing molybdenum parts and for extracting the metal from the ore are foreseen as a result of this research. With further development of the process, electroforming of molybdenum objects may become feasible.

With an output of 28,621 tons of contained molybdenum (21,629 in 1952), the U.S.A. was again responsible for some 90 per cent of the total free world supply. Chile produced 1,375 tonnes in 1952 and Canada 69 tonnes.

In January, 1954, the U.S. Bureau of Foreign Commerce announced relaxations on the export of molybdenum as a result of the improved supply position. This change has been brought about largely through expanded production by the Climax Molybdenum Company, whose mine is the largest primary source of molybdenum in the world. This year it will supply about two-thirds of the free world molybdenum output, which is forecast at 32,500 s.tons. Climax has developed a method of literally collapsing a mountain from the inside and then drawing out the ore. In this manner 8,000,000 tons of ore will be extracted during the current year. The Molybdenite Corporation of Canada Ltd. is expanding the production of its Lacorne mine, Quebec, as provided in the contract with the U.S.A.

Vanadium

A general decline in the demand for vanadium was experienced in 1953. The U.S. is the largest producer and consumer of this metal, normally accounting for over half the free world production. The Vanadium Corporation of America has obtained the approval of the Atomic Energy Commission to install at its Naturita (Colorado) mill a roaster for processing vanadium-uranium ores mined from its own properties and purchased from many independent producers. The company has exercised an option to purchase a mill at Durango, Colorado, which also processes vanadium-uranium ores.

During the year to June 30, 1953, sales of ore from the South-West Africa Co.'s mine at Abenab West included £138,640 in respect of vanadium concentrates and £882,539 for vanadic acid.

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Cadmium

BECAUSE of its growing importance cadmium makes its appearance for the first time in this *Annual Review*. By far the largest use of this metal is as a protective coating for iron and steel and, to a much smaller extent, for copper-base alloys and other metals and alloys. The second largest use is as a bearing alloy. Cadmium-base bearing metals are used successfully in internal-combustion engines for service under high pressures and temperatures and at high speeds. A cadmium-impregnated graphite is used in oilless bearings, bushing linings and for electrical purposes. Relatively small quantities of cadmium metal are consumed in the manufacture of low melting-point alloys for soldering and brazing and of fusible alloys for fire protection equipment. There is also a potentially large field for cadmium in nickel-cadmium storage batteries.

Uses in Atomic Energy

Because it absorbs neutrons readily, cadmium has found a new use in atomic energy development for controlling the fissionable elements in reactors. For atomic energy production equipment about 100 lb. of cadmium are estimated to be needed for controls in each 100,000 kW. output nuclear power plant. Compounds of cadmium have a considerable number of uses. Cadmium sulphide and cadmium sulphoselenide are standards agents for imparting high-quality yellow and red colours respectively to a variety of materials and products. Cadmium oxide, hydrate and chloride are used in electroplating solutions.

There are no cadmium ores. The entire world supply comes as a by-product from the roasting, sintering and hydrometallurgy of zinc, lead and copper concentrates. The U.S. produces about two-thirds of the total output, but over half its production is from imported ores. Last year the U.S. output increased by 14 per cent to an estimated 4,800 tonnes. South-West Africa exports lead-zinc-copper concentrates containing large quantities of cadmium. With this single exception, all large cadmium producers are also leading zinc producers. Mexico exports cadmium in flue dust and zinc concentrates, chiefly to the U.S. Canada and Australia produce refined cadmium metal. Significant quantities are also obtained by Belgium, the U.K. and France from imported ore. A new works with an initial production of 50 tons per annum is projected for Holland.

Market Outlook

Available statistics indicate that the U.S. consumes almost twice as much cadmium as the rest of the free world. In 1953 the total U.S. supply reached the new peak of 5,600 tons—an increase of more than 500 tons over the figure for 1952. The apparent U.S. consumption rose from 4,521 tons in 1952 to an estimated 4,950 tons last year. Paradoxically, stocks also increased to record levels.

It was anticipated that in 1954 activity in the cadmium industry would probably be on a slightly reduced scale, with supply and demand more closely in balance. The U.S. production was expected to drop below the 1953 level as domestic mine production of zinc and imports of zinc concentrates diminished. From 14s. 4d. in January, 1953, the price of Empire cadmium had eased to 13s. in April, 1954.

The authors of the Paley Report project a total free world demand by 1975 of 15,000 tonnes of primary cadmium and an estimated supply of about 8,500 tonnes. The long-term outlook is thus one of shortage and rising prices, which would encourage substitution. Fortunately, considerable substitution is possible.

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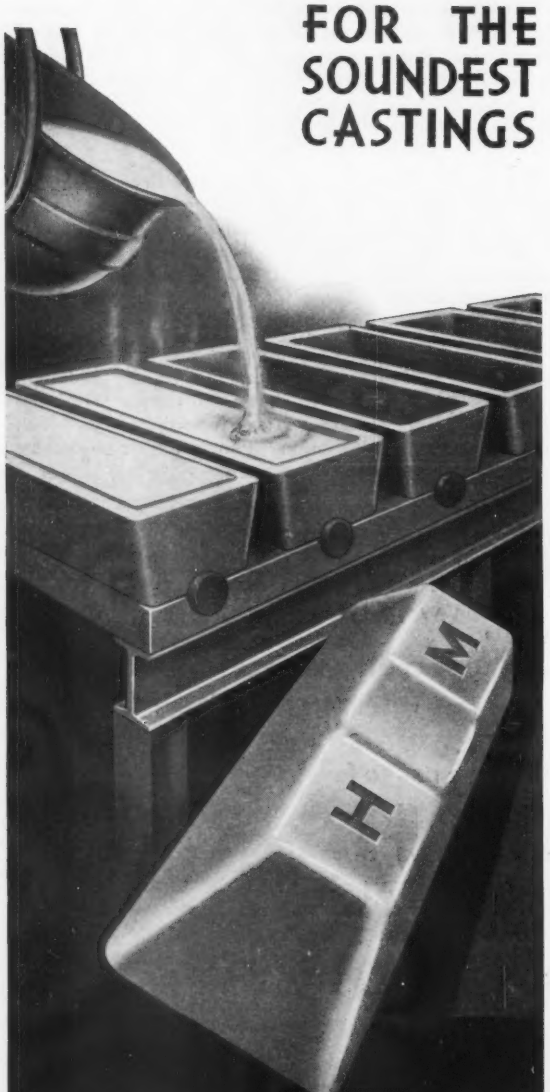

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Beryl, the sole commercial source of beryllium, was a "scarce" material for several years, but world production has been expanded from 5,590 s.tons in 1951 to an estimated 9,000 tons in 1953. As a result, supply has overtaken demand and producers of beryllium are now actively engaged in developing new uses for the metal and its alloys. The average price per s.ton unit BeO (10-12 per cent BeO) was $47 last year compared with $38.55 in 1952, but towards the end of the year there was a slight decrease and government contracts were being negotiated below this.

U.S.A. is Heavy Importer

Beryl's dependence on the United States market is indicated by the fact that in 1953 the U.S. produced 750 s.tons and imported 8,500 tons, its total new supplies thus exceeding the estimated world production for the year. Brazil supplied 34 per cent of the U.S. imports, Argentina 23 per cent, S. Rhodesia 16 per cent, and South Africa 13 per cent.

It is by no means certain that the production of beryl can be maintained at the present level. U.S. imports from Argentina during 1953 were believed to be largely from accumulated stocks. South Africa's known reserves of cobbable beryl are becoming depleted, though the Union's output last year was 531 tons compared with 413 tons the previous year. It is known, however, that the mineral occurs over large areas in South-West Africa and Namaqualand and occurrences of good quality material have been found in various parts of the Transvaal. New occurrences are continually being brought to light in Southern Rhodesia. Encouraging results are reported from exploration work on a lithium-beryllium property in Southern Rhodesia, about 45 miles from Fort Victoria.

The U.S. Government is endeavouring to encourage domestic production by a programme for purchasing beryl from small producers at prices ranging from $40 to $50 per s.ton. This programme has been extended from June 30, 1953, to June 30, 1957. High prices have not greatly increased domestic production, however, and it is considered that mechanical beneficiation processes must be developed. There is as yet no commercial process.

Prospects of Commercial Uses

The resumption of commercial production of beryllium metal, master alloys and compounds by Brush Beryllium Co. in a new plant at Elmore, Ohio, has resulted in an assured supply to fabricators. Export restrictions on beryllium-copper master alloys were relaxed in November, 1953.

A statement from the Beryllium Corporation underlines the expansion in outlets for wrought beryllium copper alloys, which promises largely to offset the impact of reduced military buying. The relaxation of controls on nickel will permit further revaluation of the commercial possibilities of beryllium nickel alloys, which have hitherto been restricted to a small group of essential uses. It is considered that the improved supply position will lead to many new and useful applications for beryllium products.

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Central African Production

By far the largest supplier is the Belgian Congo, which may have produced as much as 8,000 tons in 1953 against 6,720 tons in 1952. In certain copper deposits of Katanga, copper is intimately associated with a cobaltiferous mineralization. Union Minière produces yearly some 7,000 tons of cobalt, being 65/70 per cent of the total world output. Last year their refinery at Jadotville was enlarged.

Britain secures substantial quantities of cobalt from Northern Rhodesia, supplemented by imports of Belgian Congo material and of cobalt compounds from Canada. Northern Rhodesia produced 500 tons in 1952. Production from Rhokana's electrolytic cobalt refinery in Northern Rhodesia, which was started in August, 1952, was restricted initially by operating difficulties, but these have largely been overcome and the company's total production of cobalt metal for 1952/53 was 259 s.tons.

Chibuluma, the large wholly-owned subsidiary of Mufulira Copper Mines, is expected to come into operation in 1955. This property is being financed by loans from D.M.P.A. who have a prior option on 19 per cent of the company's cobalt output.

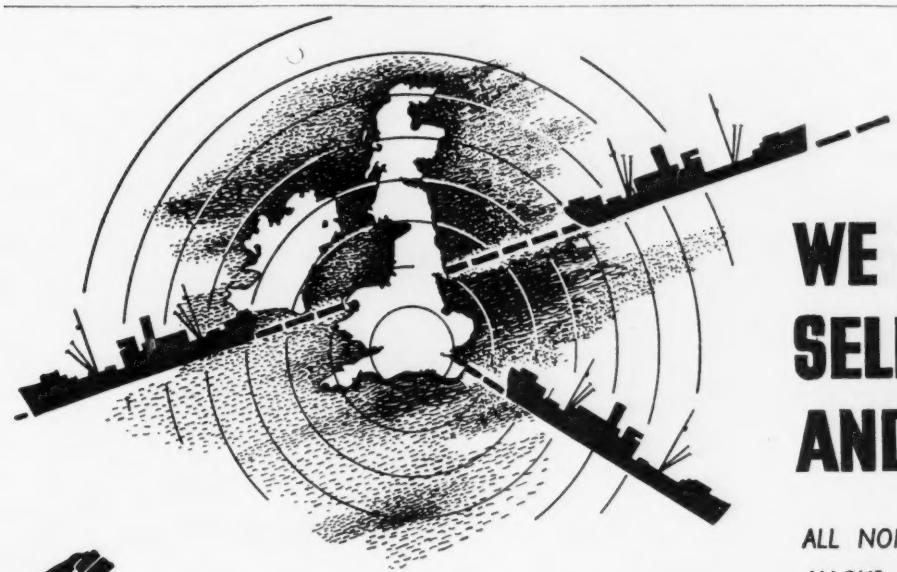
Progress in America

Canada produced 877 tons of cobalt last year. Quebec Metallurgical Industries have completed a high capacity smelter at Cobalt, Ontario, for Cobalt Chemicals Limited, which is producing cobalt, silver, nickel and copper, all from ores of local mines. Canadian output will be further expanded by the production of the refinery of Sherritt Gordon Mines, scheduled for completion about April, 1954, which will include 150 tons of cobalt, plus nickel and copper.

The U.S. is the second largest producer, its output for 1953 being 1,409 s.tons, compared with 1,014 s.tons in 1952. The Bethlehem Steel Co. and the Calera Mining Co. are the only producers of cobalt concentrates from domestic ore. The latter company's new refinery at Garfield, Utah, started shipping in May last year.

The Freeport Sulphur Co., which controls the Nicaro Nickel Company, has discovered a deposit in Cuba said to have a minimum of 40,000,000 tons of ore averaging around 1.35 per cent nickel and .14 per cent cobalt. A new leaching process devised with the co-operation of Chemical Construction Co., a subsidiary of American Cyanamid, will be employed in its treatment. A minimum annual output of 1,500 tons of cobalt is envisaged

Though the U.S. consumption of cobalt declined during the last six months of 1953, it is expected that the total for the year will prove to have been close to the record figure of 5,409 tons recorded in 1952. A firm consumer demand is foreseen for 1954, and indeed for many years to come seems likely to be limited only by availability.



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Columbium and Tantalum

By R. BRUCE DUNFIELD

COLUMBIUM, as one of the key alloying metals used in producing steel for jet engines, gas turbines, rockets and other applications where it is subjected to temperatures of 1,500 deg. F. and above, and tantalum, as a metal used in combination with or as a substitute for columbium in producing high temperature alloys, are essential ingredients for a powerful war potential.

Notwithstanding the vast potential demand for these metals for commercial applications, it was the need for them as high temperature alloys that lay behind the promulgation of the D.M.P.A. order declared on May 28, 1952. This order established an incentive bonus purchase programme under which the U.S. Government would pay a bonus of 100 per cent of the base price to the actual producers of the ore until the end of 1956, or until the U.S. Government had amassed 7,500 s.tons. Subsequently the offer was extended to include small lot shipments from U.S. producers.

Nigeria by far the Largest Producer

Nigeria supplies about 90-95 per cent of the total world requirements of columbite, the balance coming mainly from the Belgian Congo, Brazil and Portugal.

In Nigeria, columbite is mined as a co-product of tin and it has been estimated that in alluvial deposits the recovery ratio is about 1 ton of columbite to every 20 tons of tin. A few leases on the Plateau, however, and in the majority of those worked in the Kano province, the ratio of columbite to tin is as high as 1 ton of columbite for every 3 tons of tin.

Production of columbite in Nigeria can be said to have begun in 1933 when 3 l.tons were exported. Output rose rapidly to a peak in 1944 when it reached 2,055 l.tons, but thereafter declined to 864 l.tons in 1950. In 1951 the price per s.ton of concentrates containing 65 per cent $(CbTa)_2O_5$ was more than doubled, the price advancing from £413 to £831 per s.ton, which was instrumental in raising output to 1,078 l.ton, thereby reversing, for the first time in six years, the declining trend of production. In 1952 the base price was increased to £1,040 per s.ton of concentrates containing 65 per cent of columbium pentoxide and it was in relation to this price that the 100 per cent bonus offered to producers by D.M.P.A. became operative.

Some qualification is needed concerning the use of the term "base price" as there never has been an established market price for the mineral which is usually sold on short-term contracts, the price being subject to considerable fluctuations. The 100 per cent bonus scheme was effective for less than eight months of 1952 but total production expanded to 1,294 l.ton and from the evidence now available it seems more than likely that the total production in 1953 will exceed the 2,055 l.tons achieved in 1944.

Pyrochlore as a Potential Source

There are at least 30 minerals containing columbium, many of them quite rare, such as fergusonite, samarskite, euxenite, ixiolite, stibiotantalite and pyrochlore. But columbite is the only one which has been used as an ore of columbium so far. Yet the last named in the above list,

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pyrochlore, may one day in the not too distant future provide another fruitful source of this scarce mineral. Indeed, the discovery of the huge pyrochlore deposits in the Kaffo Valley, Nigeria, by Dr. R. A. Mackay, may have marked the end of the beginning of the virtual monopoly of columbite as the sole economically workable source of columbium. There are, too, large Uganda phosphate deposits which have been proved to contain a very substantial by-product content of columbium occurring as pyrochlore.

Generally speaking, pyrochlore contains columbium, tantalum, and uranium and therefore must be regarded as being very valuable, particularly as it is believed that the problems of metallurgical treatment to secure the uranium and the columbium by cheap mineral dressing techniques have been solved.

Search for New Deposits

The stimulus given to the search for and the development of ore deposits containing columbium by the D.M.P.A. bonus scheme has resulted in several potentially important discoveries. One of the most interesting during the past year was that made around Tororo in Uganda where the Tororo Exploration Company (Monsanto Chemicals, Frobisher Ltd., and the Uganda Development Corporation) announced the discovery of some 2,000,000 tons of soil containing workable amounts of apatite and pyrochlore from which it would be possible to extract 500 tons of columbium pentoxide annually.

Two important pyrochlore discoveries during the year have been reported from Canada; one near the western boundary of Algonquin Park in Butt Township, Ontario, is being examined by Deldona Mines, the other, in the Lake Nipissing area, Northern Ontario, is being investigated by Beaucage Mines, an associate company of Inspiration Mining and Development.

Broadly speaking, the lowest commercially acceptable grade of columbite ores is approximately 35 per cent, but during 1953 at least two companies in the United States have been taking tin slags containing from 7 to 21 per cent contained columbium-tantalum pentoxide from the Belgian Congo, Nigeria, Portugal and from Malaya where, if current investigations into the slag heaps at Penang and Singapore smelters prove successful, it is proposed to ship the residues in consignments of 10,000 tons to the U.S.

Australia, until about 1938, was almost the only producer of high-grade tantalite—60 per cent Ta_2O_5 or more—but since the war the Belgian Congo has become the leading producer, followed by Brazil and Portugal.

The Outlook

The outlook for the metals is extremely bright. While the D.M.P.A. order has stimulated development and production no significant deposits were discovered in the United States, which is dependent for about 99 per cent of its supplies from foreign sources. In fact, during 1952 the U.S. produced less than 3 tons from domestic sources while imports—gross weight—exceeded 1,000 s.tons. During the first nine months of 1953 U.S. imports of columbite amounted to a gross weight of 1,520 s.tons averaging 54.3 per cent columbite and 13.3 per cent tantalite, the principal suppliers being Nigeria, Belgian Congo and Portugal in that order. Tantalite imports during the same period totalled a gross weight of 236 s.tons averaging 40.8 per cent tantalite and 31 per cent columbite, of which the Belgian Congo was the chief supplier followed, by Portugal and Brazil.

Thus the U.S. Government's stockpile target of 7,500 s.tons by 1956 will not be easily attainable even if the whole of the imports are being allocated for this purpose, but no figures have been released of the tonnages made available to industry.

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Reflections on Uranium Ore Production

By ROBERT A. MACKAY, D.Sc.

IN dealing with uranium the engineer and geologist have no background of past production and prices on which to estimate the future, for though it is true he has some figures extending back well into the last century they could only deal with uses that have now become quite insignificant when set beside the main uses for purposes of war or atomic power. Nor can he have any conception whatever of the future trends in these two main uses. It may be thought that an advantage exists in the fact that officially fixed prices prevail, but when this is more closely examined it is not helpful ; also, at least two of the main producers of the world, the Congo and the Union of South Africa, have special negotiated prices undisclosed to the world.

The purpose of this article, which has been condensed from a longer version to appear in a forthcoming issue of *The Mining Journal*, is to consider some of the little information that is publicly available on the economics of uranium mining, and to make a few speculations as to its future.

Production, Uses and Prices

As an approximate indication of the rate of growth of uranium production over the past hundred years it may be said that where in 1850 production could be counted in tens of tons, between the outbreak of World War I and the end of World War II it could be counted in hundreds of tons, while to-day it is counted in thousands.

Some prices per lb. of U_3O_8 quoted in the three main English-speaking countries are given herewith : Great Britain, 25s.-35s., according to grade ; U.S.A., $3.50, according to grade and transport and development costs : Canada, ±$13, according to grade.

It will be noted that these prices differ very considerably and it may be inferred that the cost of the ore obtained from some sources is substantially in excess of these figures. Moreover, the quoted English price can be considered to be somewhat unrealistic, inasmuch that no uranium is produced in this country, and as far as the writer is aware, none is being directly searched for for its own sake (with two possible exceptions) by any companies operating from this country.

One use at present overrides all others overwhelmingly—atomic weapons. The second use is about to arrive—it has been stated in Parliament that a nuclear reactor for the production of industrial power will be with us in this country in less than three years and that at least one other is already planned. The size of these power plants is also unknown but a guess can be hazarded that they will be large, and that substantial amounts of uranium can be consumed in them and the plants which may follow over the coming decade. America has also embarked upon projects of this kind and could well do so increasingly. Of course, nobody outside the security groups can possibly prognosticate in actual figures what such expansion could mean. In addition to this, it depends too on whether breeder piles work satisfactorily or not, for if they do not, much larger quantities of uranium will be needed for industrial uses.

It would seem relevant to say that should our own industrial experimental power piles prove economic as well as efficient, the policy in this country would dictate that more be built as rapidly as our national resources permitted in order to take care of power expansion without going after difficult coal resources that would be needed to achieve the same end.

Classes of Deposits

Uranium deposits may be divided into two main classes : primary, where the deposits, almost certainly all hydrothermal, are worked for the uranium essentially ; and by-product, where the uranium is obtained by the working of some other mineral such as gold, niobium, phosphate, or oil shale.

Hedged round with secrecy as the subject is, it is impossible to state what the grades of various deposits of the world are, and so to give precise ideas as to what grades are economic. In South Africa this secrecy is carried to the greatest extremes, and it is only possible to say that from published figures some thousands of tons per annum must be contemplated and the grade must lie between .06 per cent and .006 per cent (say, $1.5 to $15 at Canadian prices), but this should really be considered under the by-product class of deposit.

In Canada, however, there has been a greater freedom of discussion and one can say that prospectors there consider that a small deposit of 1 per cent is definitely worthwhile, (and so it should be, for such deposits will be rare) whereas a large deposit of .1 per cent also is considered in the range of profit making. Such have easily attracted capital when in the millions of tons class.

All primary uranium deposits are of various hydrothermal types, and it is worthwhile in passing to say that there are no economic alluvial deposits of uranium in the world and none may be expected. Davidson, in 1949, suggested that .4 per cent was well worth investigating for occurrences of the order of 10 tons of contained uranium oxide, which still seems realistic for the small man. It is, however, probable that for very large tonnages anything above .05 per cent should be considered at the prospecting stage. Costs of mining and treatment would have to be low in such a case. It may be noted that on Canadian price .05 per cent is roughly equivalent in gross value content to 7 dwt. ore in gold, or on British prices a 3 dwt. ore, and that the cost of mining would in no way be categorically different from that of gold, while the cost of milling to produce a saleable concentrate should be no greater in the case of an easily-dressed uranium ore. The milling costs could be very considerably greater if an ore were complex.

All that is suggested here is that anything above .05 per cent on big tonnages is worth investigating. If this figure is reasonable, then it also follows that .1 per cent becomes worth investigating on moderate tonnages, say of the order of 100,000 tons.

Turning to by-product sources, reference is made elsewhere in this article to the Witwatersrand. In discussing the Rand, tribute should be paid to the foresight of C. R. Davidson and George Bain for their early recognition of the possibilities in the face of much argument. The futility of applying secrecy as to what the actual figures are in this field can readily be appreciated when the total tonnage from the mines producing uranium is published, their past dumps can be easily estimated and, by a very little, very simple arithmetic, the potential of the country can readily be gauged by an intelligence officer. Surely we are embarrassing our own industry to a greater extent than we are embarrassing any potential enemy, to whom accurate figures are far less important than a general estimate of potential.

Another source of the future is pyrochlore. Not all pyrochlore contains useful amounts of uranium but some of it does certainly, notably a large deposit in Nigeria and some in Canada. The possible potential is, however, only of the order of hundreds of tons per annum from a world production viewpoint.

The writer is not aware whether serious production is yet coming from by-product extraction from phosphates which commonly run from .01 to .005 and sometimes above this range ; a little simple arithmetic can estimate this potential, which sems to be of the maximum order of 1,000 tons or so per annum.

The World Sources of Uranium

A few years ago the Belgian Congo was definitely the leading producer—it may still be in the lead—and Great Bear Lake was second. Since then the Rand has started to produce and may eventually rival Canadian production, certainly Canadian production of a few years ago ; but since then also the Canadians have discovered much new ore. There have, of course, been many hundreds of bucket shop and wild cat operations in Canada, but the Athabasca area seems to be a genuine and important discovery of the moderate grade type ; .1 per cent is considered commercially interesting there, though there will probably be patches and bodies which go considerably above this.

Australia has also entered the field but from a production point of view is presumably still unimportant ; though Rum Jungle might become an important producer later. The United States have intensive work on the Colorado carnotite fields and elsewhere, but this probably does not include any of the world's major sources.

It is suggested that though seemingly Canada is geologically the most richly endowed, the freedom with which industry has been allowed to participate in uranium mining (though subject to proper security controls of the necessary type) has done much to contribute to the rapid advance of Canada in this field. On the other hand, in the Colonial Empire there are specific cases of properties which could have interested industrial houses where the fact of government participation discouraged participation by companies concerned ; also some of the work done by government organizations has not been made as freely available as it might have been.

Conclusions

Production is still mounting. It is difficult to assess to what degree progress is due to the effort being expended and prices offered on the one hand, and to the natural endowments of the countries on the other ; certainly Canada leads in both. The Colonial Empire moves slowly, perhaps hindered to some extent by the fact that the industrialists do not feel that they are much encouraged, perhaps by the fact that we have only one geologist available in this speciality in the rest of the Empire for at least ten in the New World

If the prognostications in the Paley Report are true the mounting demand for raw materials and for power will mean, in some of the older countries at least, that some of this power will have to be supplied by nuclear energy. Unless, therefore, breeders reduce the necessity for raw uranium to a very drastic extent it may be expected that no further than a decade from now industrial needs will begin to mount seriously. So far, the world has proved insatiable in its demands for increased power requirements. There seems no reason why this trend should cease and when a means is ready to supply to those countries poorly endowed with fuel or water power surely this need must increase the demand for uranium.

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Coal

By W. DAVIES, Ph.D., B.Sc.

THE recent announcement of the British Government's intention to embark on schemes for generating power from nuclear energy has given rise to speculation about the probable effect of this development on the coal industry. The chairman of the National Coal Board believes that coal will continue to be the main source of energy in European economy for many generations to come and that all the workable reserves of coal in Britain will be mined eventually. The president of the High Authority of the European Coal and Steel Community has stated on the other hand that a cautious attitude is being taken on the Continent towards any long-term expansion policy for coal at any rate until the situation becomes clearer.

The demand for coal in North America has been falling for some time on account of a growing preference for liquid and gaseous fuels and it is predicted that during the next few years the coal industry in the United States and Canda will have to cut total production and also find ways of reducing mining costs to enable coal to be sold at a price which will give it a greater economic advantage over oil and natural gas. Coal now takes second place as a source of heat and power throughout America, but in Western Europe it still provides over 80 per cent of the energy used in industry. Moreover, the demand for coal in Europe is still unsatisfied and is likely to go on increasing for at least another decade notwithstanding any contribution which nuclear energy may make towards the supply of electricity.

PRINCIPAL PRODUCING COUNTRIES
(in millions of metric tons)

	1951	1952	1953†
U.S.A.	523	460	**435**
European Community	318	354	**321**
U.S.S.R.	290	300	**N.A.**
Great Britain	226	230	**228**
Poland	87	92	**N.A.**
Czechoslovakia	49	53	**N.A.**
China	43	51	**N.A.**
Japan	43	42	**47**
India	32	36	**36**
Union of South Africa	26	28	**29**
Australia	24	25	**23**
Canada	17	17	**16**
New Zealand	3	3	**3**
Southern Rhodesia	2	2	**3**

† Provisional.
These figures include output of lignite.

The changing pattern of fuel utilization in the United States and other parts of the world will undoubtedly influence future trends in the techniques of using coal. If the demand for liquid and gaseous fuels continues to grow at the present rate it may become necessary to exploit oil shale deposits and to manufacture these fuels on a large scale from coal. A move in this direction seems to have been taken already in South Africa where work was started last year on the construction of plants for the production of oil from low-grade coal by the Fischer-Tropsch process. Much work is also being done in Great Britain and on the Continent on schemes for the collection of surplus industrial gases and methane which is drained from mines for use as fuels.

North America

The output of coal in the United States last year was 480,000,000 tons compared with 507,400,000 tons in 1952, and in Canada it was 16,000,000 tons compared with 17,580,000 tons in 1952. The fall in the demand for coal in both countries is attributed to a growing preference for oil and natural gas. Since 1950 the consumption of coal on the railroads of the United States has been falling at the rate of 10,000,000 tons a year because of the substitution of diesel engines for steam locomotives and it seems that all long-distance transport over the whole of the American Continent is destined to become entirely independent of coal unless the coal-burning gas turbine becomes a successful rival to the diesel engine. Relatively, the drop in the production of anthracite last year was greater than in the case of bituminous coal.

Western Europe

The output of coal and lignite in Western Europe in 1953 amounted to 464,000,000 tonnes. Of this total 227,800,000 l.tons of hard coal was produced in Great Britain under the National Coal Board and 236,200,000 tonnes of coal and lignite were produced on the Continent under the auspices of the High Authority of the European Coal and Steel Community.

A common market for coal was established on February 10, 1953, when customs duties and all other restrictions on the movement and sale of coal throughout the Community were abolished. The removal of these restrictions resulted in an increase of 20 per cent in inter-State coal traffic during the year compared with 1952 and a reduction of 10,000,000 tons in imports from the United States. The High Authority's annual revenue now amounts to about £17,000,000 derived from a tax of .9 per cent on production.

Nearly half of this revenue comes from West Germany and rather less than a quarter from France. Administrative expenses and research absorb 12 per cent of it and 15 per cent is spent on the welfare and re-adaptation of workers who may become displaced as a result of policies adopted by the High Authority. The remainder goes into a fund to guarantee loans raised in the United States and elsewhere for investment in the coal and steel industries.

The High Authority takes no direct part in the planning or management of the mines but it can regulate production by virtue of its control over the distribution of coal and the allocation of capital for reconstruction and development. Its immediate aims are to increase the production of coking coal by about 20,000,000 tons a year and to raise productivity in the mines to the level of that in Great Britain. The trends in European coal productivity during the last three years are shown in the following table :

Country	*Number of workers underground (in thousands)*			*O.M.S. underground expressed in metric tons*		
	1951	1952	**1953**	1951	1952	**1953**
Great Britain	540.0	555.0	**562.0**	1.632	1.608	**1.615**
W. Germany	310.0	322.0	**333.3**	1.457	1.475	**1.464**
France*	204.0	204.0	**200.0**	1.298	1.353	**1.482**
Belgium	115.0	119.0	**118.0**	1.054	1.051	**1.070**
Netherlands	28.0	30.0	**30.1**	1.725	1.609	**1.570**

* Including the Saar.

The relationship between Great Britain and the Community remains unchanged but efforts are being made to reach more definite agreements on coal marketing arrangements on the Continent, but this is a difficult problem on account of differences in fiscal policies.

Great Britain

The year 1953 opened inauspiciously for the National Coal Board with falling productivity and mounting costs in the coalfields. To meet this situation the price of coal had to be increased by 10 per cent on March 10 and a further rise took place recently to cover increased freight charges. Consumers in the London area now pay from

103s. to 153s. per ton of coal according to grade whilst the average cost of production is about 61s. a ton. The particulars given in the table on this page show that the results for the year as a whole were better than might have been expected in view of the loss occasioned by the extension of the summer holidays from a week to a fortnight.

A marked increase in production took place during December and the Board regarded this as evidence that the mines are now technically capable of yielding a higher output. Therefore when they agreed recently to raise the minimum wages to £7 15s. a week underground and £6 15s. a week on the surface they did so on the understanding that an effort would be made to increase the annual production by 5,000,000 tons. If this promise is fulfilled the output in 1954 should be the highest since 1940.

OUTPUT AND MANPOWER IN GREAT BRITAIN

		1952	1953
Deep-mined coal	(millions of tons)	212.7	**211.8**
Opencast Coal	(millions of tons)	12.1	**11.7**
Total	(millions of tons)	224.0	**223.5**
Inland consumption	(millions of tons)	206.0	**207.5**
Exports and bunkers ...	(millions of tons)	15.0	**16.5**
O.M.S. at face	(tons)	3.149	**3.143**
O.M.S. overall	(tons)	1.195	**1.211**
O.M.S. per man-year	(tons)	299.0	**296.0**
Number of face workers	(thousands)	294.0	**300.0**
Total number of workers	(thousands)	716.0	**717.0**
Average cost of production	per ton	£0.000	**£0.000**

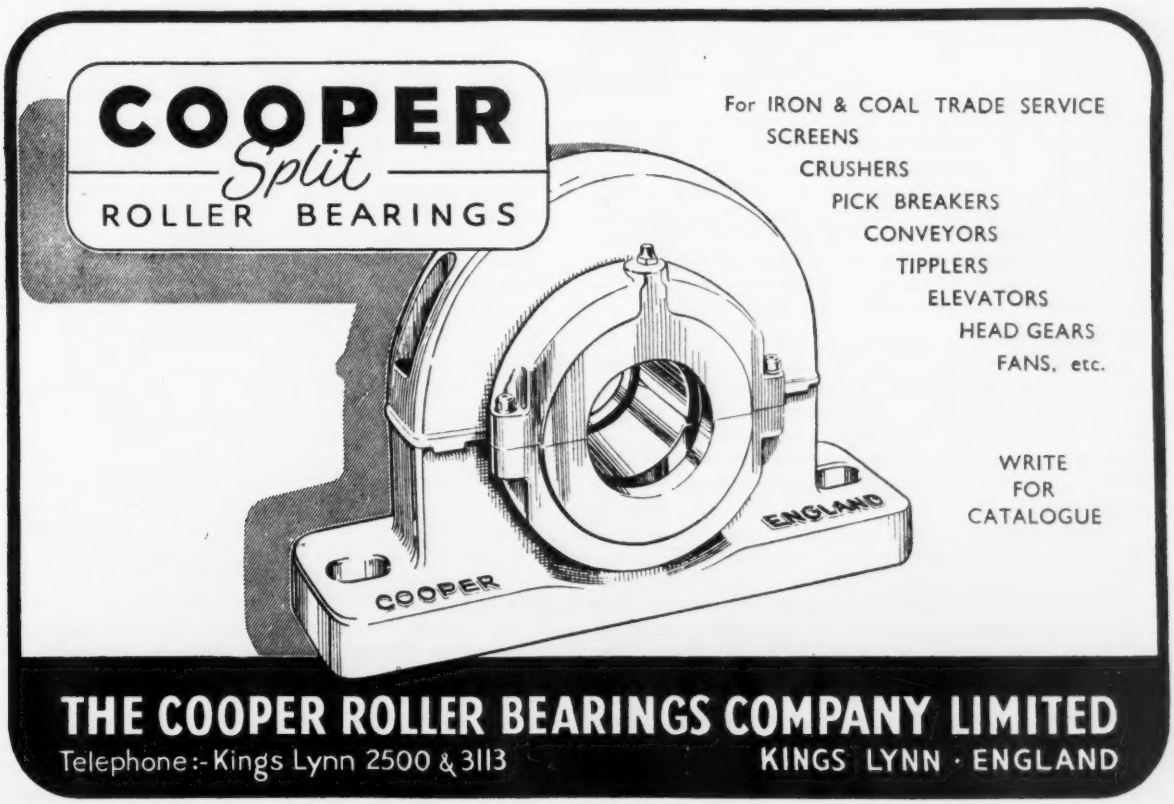
Ten out of the 20 new deep mines included in the "Plan for Coal" are now being sunk. Four of these are in Scotland, three in the Midlands and two in the South Wales anthracite coalfield. They have been designed for individual outputs ranging from 750,000 to 1,250,000 tons a year and for an aggregate annual output of 10,000,000 tons. The capital outlay will be about £6 for every ton of coal produced in a year and the interest and depreciation charges will amount to about 16s. a ton compared with 2s. 4d. at present. Consequently, it must be expected that much of the financial advantage of increased productivity in the new mines will inevitably be swallowed up by inflated capital costs.

The decision to modernize the South Wales anthracite industry was one of the outstanding events of 1953. The reserves of high-grade anthracite in this coalfield constitute one of Britain's most valuable natural resources, particularly for export. The annual output before the war was about 5,000,000 tons but now it is only 3,500,000 tons, including 500,000 tons of open-cast coal.

As matters now stand there are about 38 anthracite collieries in South Wales, most of which are small drift mines with an average output per manshift of .65 tons and very high working costs. The two new mines are to be laid out on the horizon system from shafts about 800 yds. deep to intersect the lower series of seams which range in thickness from 2 ft. 6 in. to 8 ft. and it is expected that the output per manshift will be of the order of 1.5 tons.

Australia and the Far East

The output of coal in the Pacific area in 1953 was about 114,000,000 tons or approximately half that in Great Britain. Australia and Indo-China produced more than they consumed but over the area as a whole there was a shortage of 4,000,000 tons which had to be made good by imports from the United States and India. Coal is the principal source of energy in industry but it is not widely used for other purposes. Wood and waste vegetable products are the main domestic fuels and the amounts consumed last year were equivalent to no less than 168,000,000 tons of coal.



Oil

By W. J. HARRIS

THOSE who support the old saying, "Nothing succeeds like success," might well advance as justification for this theory the achievements of the international oil industry. Exactly a year ago *The Mining Journal*, in a review of the industry's activities in 1952, forecast an equally impressive rate of development during 1953. That forecast has since been proved justified in every respect, and, as shown in the accompanying table of estimated world oil production, 1953 again saw new records.

The United States

As usual, the United States of America heads the list of nations as the world's largest single oil-producing country. She was responsible once more for approximately half the entire world's output of crude oil (including natural gasoline). Somewhere in the region of 50,000 new bore-holes were completed in the U.S.A. last year—this figure, incidentally, setting up another new record. For the first time, too, in one of these U.S. bore-holes, the drill reached down to a depth in excess of 21,000 ft., while a new record depth of 17,895 ft. was established in another U.S. well as being the greatest depth anywhere from which oil is being actually produced.

U.S. oil industry expenditure during 1953 reached the staggering level of $4,000,000,000 (£1,421,000,000). This expenditure, of course, covered not only outlay on exploration projects and expansion of existing oilfields but also the cost of refinery construction programmes, pipeline projects, research activities and other oil industry undertakings.

WORLD OIL PRODUCTION
(inc. natural gasoline)

	Tonnes 1952	**1953**
U.S.A.	332,300,000	**342,000,000**
Venezuela	94,900,000	**92,000,000**
U.S.S.R. (inc. Sakhalin)	47,500,000	**52,000,000**
Saudi Arabia	40,400,000	**41,000,000**
Kuwait	37,600,000	**43,000,000**
Iraq	18,900,000	**28,000,000**
Mexico	11,100,000	**10,500,000**
Indonesia	8,400,000	**10,000,000**
Canada	8,300,000	**11,000,000**
British Borneo	5,100,000	**5,000,000**
Other countries	35,900,000	**40,500,000**
Total world production	640,400,000	**675,000,000**

N.B.—World oil production figures for 1953 are preliminary and provisional pending publication of final figures later in this year.

Venezuela

Still easily holding her own long-established place as the world's second-biggest oil-producing nation—and the world's largest single oil exporter—was Venezuela. The fact that her output last year was very slightly below that of 1952 was entirely attributable to fluctuations in the delicate mechanism governing supply and demand in those markets absorbing the bulk of Venezuela's output. Notwithstanding this exceedingly minor decrease in her annual output, Venezuela's oil industry can be said to have generally enjoyed a highly satisfactory year.

The Middle East

Excluding from this survey the U.S.S.R., whose oil production is mainly required to satisfy home consumption, the next most important oil-producing countries are the Middle Eastern lands of Kuwait, Saudi Arabia, and Iraq. Each of these three countries improved upon their respective 1952 outputs—which means that each achieved a record production for 1953.

Topping the Middle East production table for the first time is Kuwait—followed extremely closely by the country she has just surpassed, Saudi Arabia. It is interesting to note here how both countries have now seen their production rate brought to a level that is considerably in excess of Persia's best annual output of 32,300,000 tonnes. This was attained, incidentally, in 1950, last full year of operation in Persia prior to the expropriation, and in that same year total Middle East production amounted to just above 88,000,000 tonnes. Last year, by contrast, this combined output approximated to 121,000,000 tonnes, despite the complete absence of any contribution by Persia.

The most spectacular rate of increase has been that recorded in Iraq. As the table indicates, last year's output here was some 10,000,000 tonnes in excess of that for 1952—just as 1952's production was about 10,000,000 tonnes ahead of that for 1951. This sharp upswing in Iraq's yield reflects, of course, the coming into operation in the spring of 1952 of the large-diameter Kirkuk-Banias crude-oil pipeline. This line, with an annual carrying capacity of 14,000,000 tonnes, made possible the immediate stepping-up of the rate of production from the Kirkuk wells.

Any survey of recent developments in Middle East oil operations must touch on one undertaking which may have an important bearing on future Middle East oil production. That is the search, now on foot, for underwater oil resources in the Persian Gulf itself. This particular search is especially interesting to Britain because of the substantial participation in it by British interests.

These interests, in conjunction with French associates, are carrying out two investigations off the Trucial Coast—in the vicinity of the sheikdoms of Abu Dhabi and Dubai. In association with Dutch partners, other British interests are also concerned in a third Persian Gulf underwater exploration project, off the coast of Qatar. Meanwhile, a fourth underwater oil search—this time entirely an American undertaking—is in hand off the coast of Saudi Arabia. In this last instance, existence of underwater oil deposits has already been established, though commercial production has not yet begun.

The Far East

In the Far East oil production followed a pattern of steady rather than rapid development, but nevertheless Indonesian output was raised to a new high level of 10,000,000 tonnes—principally due to the successful expansion of the newly-established Minas field where production only began as recently as the spring of 1952. Another interesting development which was continued during 1953 was the search to see if extensions offshore could be found of the important British Borneo coastal oilfield of Seria. This quest has now been taken to the point where test wells are being drilled from platforms 5,000 ft. or more from shore.

Australia

In Australia the event of last year, so far as crude oil exploration was concerned, was the news of the find of crude oil traces at Exmouth Gulf, Western Australia. Though at the time of writing it is not possible to evaluate the extent of the discovery or to estimate the possibilities of establishing commercial production on any definite scale, that a discovery has been made was a deserving outcome of a search that has taken the interests concerned some two years to carry out and which is estimated to have cost nearly £2,000,000 before the find was made.

The discovery well at Exmouth Gulf has now been deepened to between 7,500 and 8,000 ft. (the initial discovery of oil was made at a depth of 3,600 ft.). Though no further oil traces have yet been found at lower levels, plans call for the well to be taken to an ultimate depth of 17,000 ft. if necessary and in addition a second test well in the same locality is also to be sunk, as are six development wells. Other exploratory drilling is to be carried out in adjacent

areas, and the company concerned expects to spend another £2,200,000 sterling in 1954 on its operations in the Exmouth Gulf region. All told, four major international oil companies—with British interests represented—are now associated with current oil exploration projects in Australia.

Canada

No review of the major oil discoveries and searches during 1953 is complete without reference to Canada. The search for fresh oil deposits here has been pushed ahead extremely vigorously. Last year some 175 geophysical survey teams were in constant action and out of the $350,000,000 spent during 1953 on Canadian oil operations (exclusive of pipeline construction costs) some $50,000,000 were spent on geophysical survey programmes. How much more yet remains to be done in the exploration for Canadian oil can be seen from the fact that, despite the intense search of recent years, only a small fraction of Canada's most promising potential oil-bearing regions have been tested by the drill. For example, some 500,000 or more square miles still remain to be explored in British Columbia, Alberta, Saskatchewan, and Manitoba—plus, possibly, large additional areas in the remote North-West. As it is, Canada's oil output in 1953 far exceeded that for any other year in her history.

What was described at the time as the most significant development in Canadian oil history since the completion of the inter-provincial pipeline in 1950 occurred in October, when the 718 mile, 24 in. dia., trans-mountain oil pipeline was opened. This pipeline carries Albertan crude oil from Edmonton to Vancouver.

Expansion of Refinery and Tanker Capacity

So much, within the brief space of this article, for the chief developments in crude oil production and the search for fresh oil deposits that characterized 1953. What other significant progress was made in the expansion of all those facilities that a constantly increasing output of oil demands? Refinery construction work in all parts of the globe proceeded briskly. The initial expansion programme of Britain's own refining capacity had, of course, to a large degree already been completed before 1953 opened. But last year saw the finishing touches put to the programme as originally drawn up. Abroad, the new Middle Eastern refinery for Aden was pushed ahead of schedule—it is, in fact, expected to be in operation before the end of 1954. This plant will have an annual capacity of 5,000,000 tonnes and will cost about £40,000,000. Also developing to plan are the several large new refineries in Australia. These plants, all of which will be completed before the end of 1955 and which will represent an oil industry expenditure of £80,000,000, will give Australia an annual refining capacity of about 8,000,000 tonnes.

The world's tanker tonnage, too, steadily increased through 1953. Approximately 3,500,000 deadweight tons of new vessels were completed over the year, and the world's total deadweight tonnage (at the end of December last standing at approximately 36,000,000 d.w.t.) is now just over twice its pre-war level.

Petroleum Equipment an Important British Export

Another factor proving most favourable to Britain is the manufacture of all types of petroleum production equipment. This has established itself as an undertaking capable of earning us the best part of £100,000,000 annually and, since the oil industry has such a tremendously wide range of requirements in its equipment needs, these orders are inevitably being spread over an equally wide variety of firms.

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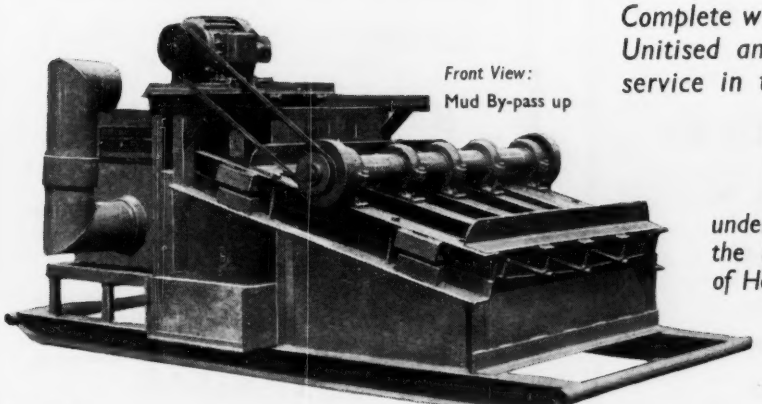

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Asbestos

BY the beginning of 1953 the world output of asbestos had to a considerable extent caught up with demand, and in consequence buyers were becoming more selective. This tendency became increasingly pronounced and a number of small and medium producers in Southern Rhodesia and South Africa had difficulty in disposing of their products. During the first ten months of the year the demand was only 3 per cent lower than in 1952, but by the end of October a marked deterioration in the Canadian sales picture became apparent. In January this year the demand fell sharply to a level 9-10 per cent lower than that of January, 1952.

The expansion in production facilities and the possibility of heavy Russian offerings are likely to have a dampening effect on the market. This may accelerate the tendency for big companies to squeeze out small producers.

North America

Canada produced 911,713 s.tons of asbestos last year compared with 929,339 s.tons in 1952. Expansion schemes costing $35,000,000 are being undertaken by Canadian mines and their effect will be felt during the current year, in which several large extensions are scheduled for completion. Among them are Johnson's new 4,000 ton mill, Asbestos Corporation's new Normandie mill, and the first section of Johns-Manville's new plant at Asbestos, Que.

The A.S. and R. and the United Asbestos Corporation are reported to be putting up some $20,000,000 to drain the Black Lake at Thetford and develop asbestos deposits believed to be the largest in the world.

New discoveries have been made in Northern Ontario about 15 miles north of Heron Bay on the north shore of Lake Superior. Pic River Mines and MacLeod-Cockshutt Gold Mining are prominent in the exploratory work.

Southern Africa

Southern Rhodesia produced 87,839 s.tons last year compared with 84,834 tons in 1952. During the second half of the year marketing difficulties affected many of the smaller independent companies. At a meeting in the Belingwe district, with Mr. G. A. Davenport, Minister of Mines and Transport, in the chair, a committee of six producers was appointed to examine suggestions as to how best the market might be restored. It was strongly felt that a selling organization to market the products of small and medium producers should be established by the S. Rhodesian Government and financed by producers. Among the mines seriously affected by the changed market outlook were New Monteleo's Rhomonte and Biltong properties, which have been placed on care and maintenance.

Small producers in South Africa experienced similar difficulties, and the Union's total output of all grades at 95,927 s.tons was lower by 24,682 tons.

On the other hand, some of the strong corporations operating in Southern Africa continued to hold their own. In Southern Rhodesia a new company was formed by the Johns-Manville Corporation in the Masheba area.

Asbestos mining has been making substantial progress in Australia, which shipped 966 tons to the U.S. in 1953. In Brazil there was a production of about 900 tons of chrysotile last year by Minas Gerais and a similar output by French interests. In Venezuela, American capital has gained control of Amveco, C.A., and the Montanita.

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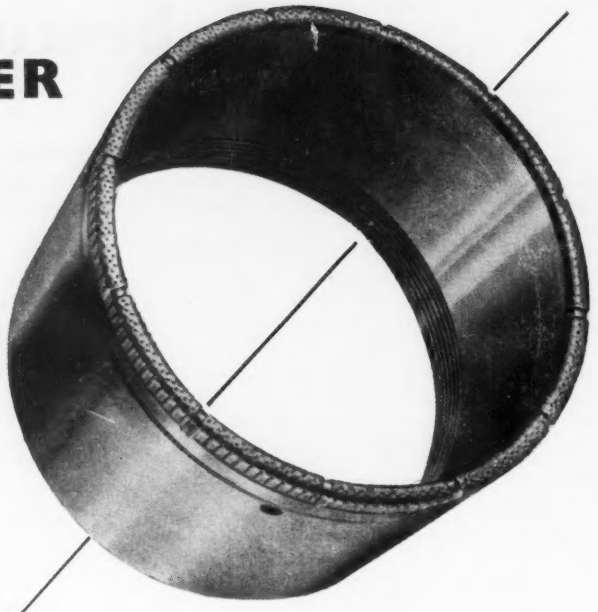

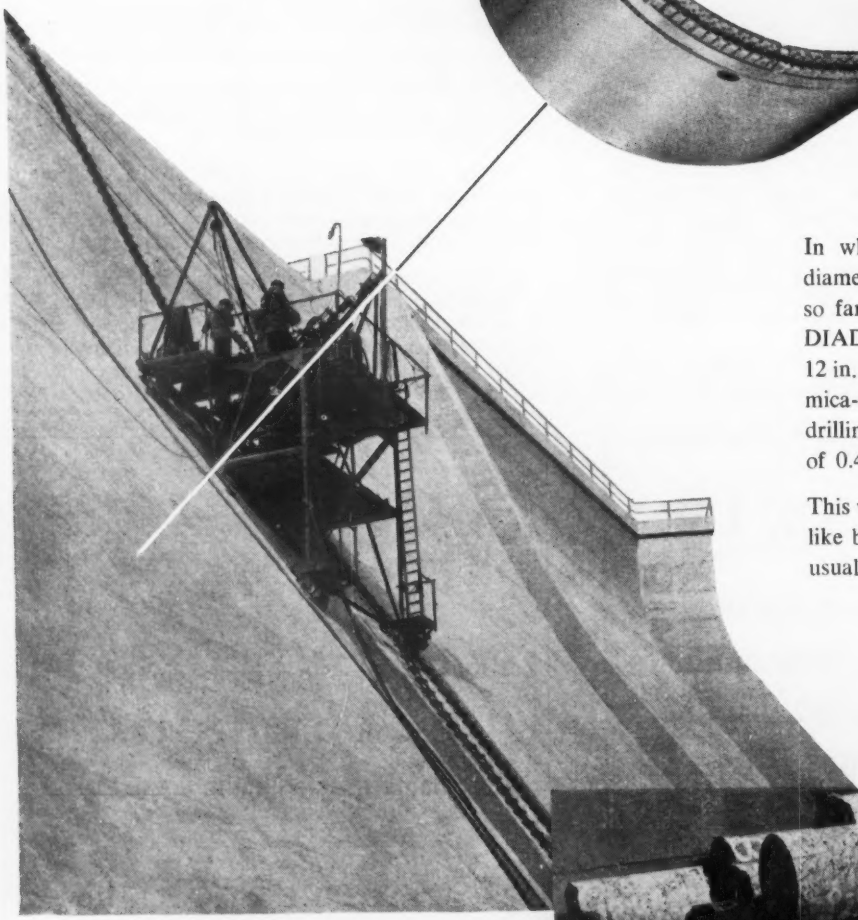

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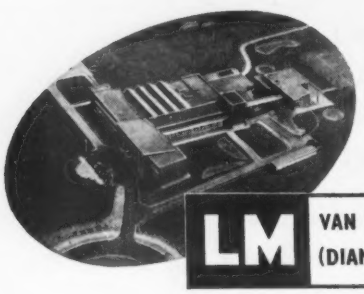

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The Diamond Industry

By a Special Correspondent

THE total sales of diamonds by the Central Selling Organization, comprising the Diamond Trading Co. and Industrial Distributors, showed a slight recession, the first for four years. This recession, however, was not so serious as those of 1947 and 1949. In spite of the statistics shown, the gem polishing industry seems to be more seriously affected than the industrial side, as can be seen from the reduction of workers in a number of countries while in others there are serious labour difficulties and actual unemployment in this branch of the industry. The high figures recorded in 1952 were obviously due to industrial sales, which reached 34.3 per cent of the total sales; in 1953, however, this figure was reduced to 29 per cent, thus following the pattern of figures recorded for the years following 1947. It is open to conjecture whether the drop in industrial sales by 25 per cent compared with the previous year indicates a reduction in the stockpiling programmes.

SALES OF GEM AND INDUSTRIAL DIAMONDS

Year	Gems (£000,000)	Industrials (£000,000)	Total (000,000)	Industrials as % of total
1944	13.2	3.8	17.0	22.3
1945	21.0	3.5	24.5	16.7
1946	26.1	3.5	29.6	11.8
1947	20.1	4.4	24.5	18.0
1948	26.8	11.3	38.1	29.6
1949	20.0	8.4	28.4	29.6
1950	38.3	12.6	50.9	24.8
1951	46.8	18.3	65.1	28.0
1952	45.8	23.9	69.7	34.3
1953	**43.3**	**17.8**	**61.2**	**29.0**

In the following account of the diamond industry in 1953 allowance must be made for the fact that some statistics have not been available at the time of writing, and those available have not always been sufficiently detailed as to amounts or values. Furthermore, the diamond qualities are not always sufficiently separated. The price ratios of the lowest quality boart (a): industrial stones (b): gemstones (c) is about of the order: a : b : c = 1 : 12 : 20.

Production Country by Country

Detailed data on the diamond production of British Colonial territories (Sierra Leone, Tanganyika, Gold Coast and British Guiana), which together produce about 2,750,000 ct. annually, are given in the British Government's Report on the Economic Survey of the Colonial Territories.[1] The production figure given for these Colonies represents about 15 per cent of total world production.

Angola. The annual report of the Angola Diamond Co. for 1952, issued on July 14, 1953, revealed new diamond deposits of apparent promise, with an estimated coverage of .14 ct./cu. m. over the surface area of 36 hectares. Exports during the first half of 1953 totalled 359,971 ct. valued at about $5,000,000; these exports averaged about 60 per cent gemstones and 40 per cent industrial stones, of which even in the latter category many of the stones could be classified as low grade gemstones. A study on the diamond deposits in north-east Angola (Lunda) by C. Freire de Andrade has recently been published.[2]

Belgian Congo. The figures for production from the Belgian Congo, the world's largest producer, are already available. Output for 1953 totalled 11,798,104 ct. compared with 10,985,791 for 1952. About 96 per cent of the 1953 output were industrial stones. Exports during the first seven months amounted to 6,653,841 ct. of industrial stones and 334,836 ct. of gemstones. The Belgian Congo has thus increased its production figure for 1953 over 1952 by 812,000 ct. The average price obtained was about Belgian Fr.60 for industrials and Fr.226.7 for gemstones. The latest figures show a slight increase in production each year. (More complete statistical data for the years 1951 and 1952 are given in *Mineral Trade Notes* 1953, Vol. 37 (6) December, pp. 42-44.)

Brazil. The official statistics issued during the year showed a reduction in the annual production to 200,000 ct. A. T. Steele, in *The New York Herald Tribune*, recalls that Brazilian diamond dealers usually estimate a 300,000 ct. production. One expert even believes that the actual production might run close to 500,000 ct. The question is also raised in Mr. Steele's article as to the destination of these diamonds.

British Guiana. Production for 1953 was 35,305 ct. compared with 38,304 ct. in 1952.

French Equatorial Africa. Production during the first half of 1953 amounted to 67,186 ct.; exports amounted to 74,096 ct. The production and export figures for 1951 and 1952 were about 150,000 ct., with a value of 2,203 Fr./ct. during 1952. About 7,500 workers were employed at the end of 1952.[3]

French West Africa. Production for the first half of 1953 was 88,252 ct., while 95,245 ct. was exported.

Gold Coast. The production figure for January to June, 1953 was the lowest figure reported for a long time, as a result of a hold-up in work from May 15 to June 19. London prices are quoted as 36-37s. per ct. The figures for July, August and September, 1953, are 134,043 ct., 100,510 ct., and 100,494 ct., respectively. Exports for the year are reported as 2,165,345 ct. against 2,051,496 ct. in 1952. The findings of the Committee of Inquiry appointed in 1951 by the Ministry of Health and Labour in the Gold Coast disclosed that the labour conditions in the African diamond mines were appalling, the ground itself ruined, and illicit diamond digging and trafficking rife.

India. Acting on a favourable report, the Diamond Mining Syndicate, who operate the Panna mines, installed a pilot mill with an eventual capacity of 250 tons per day. This is now in operation, but not yet at full capacity. It is planned to install a plant capable of treating 3,000 tons of diamond-bearing rocks from the Mujgawan pipe. Tests indicate that recovery may be comparable with the yield of some of the African diamond mines.

A systematic examination of the Mujgawan diamond deposits of the Panna district has recently been completed by the Indian Bureau of Mines. The Mujgawan diamond-bearing pipe is not the source of diamonds in the associated pre-Cambrian Vindhyan conglomerates. Large diameter drilling and systematic surface sampling of the pipe, as well as shaft sinking, is recommended.[4]

Sierra Leone. During the year negotiations took place between the Colonial Office, the Sierra Leone Government and the Sierra Leone Selection Trust with regard to the disposal of revenue from the Kono district diamond workings. The Sierra Leone Government hopes to increase its share of this relatively big producer. This problem is discussed further on page 137.

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Exports from Sierra Leone in 1953 totalled 416,742 ct. against 452,618 ct. in 1952.

South Africa. Dr. Van Rhyn, Minister of Mines, announced that 40 tons (178,000,000 ct.) of diamonds worth £429,691,503 had been produced in South Africa between the time of the first diamond discovery and 1952, when sales were 2,349,743 ct. valued at £14,776,482. In 1953 sales increased to 2,647,370 ct. but the value declined to £13,210,269.

A diamond of 274½ ct. and another of 168¾ ct. were recently recovered from Jagersfontein mine. This mine yielded, during the period from 1893 to 1907, seven stones all over 335 ct., the largest weighing 971 ct. In Jagersfontein, as in other mines, new belt conveyors have replaced the endless rope haulage system previously prevailing.

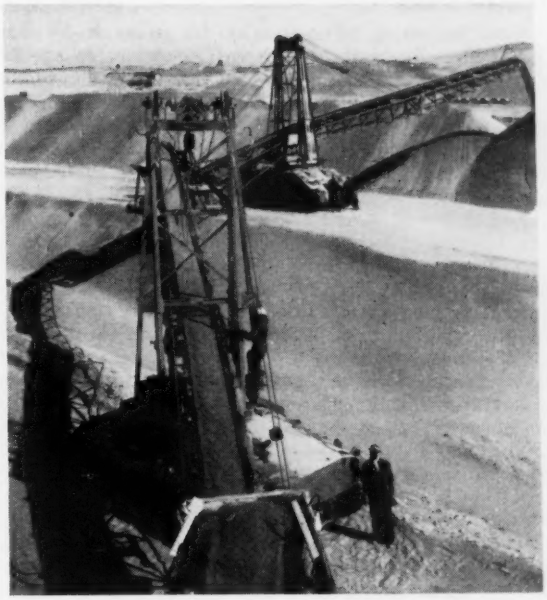
Various aspects of diamond mining at Kimberley were treated by R. Daniel,[5] manager of the Dutoitspan mine, in an article dealing in particular with the improved techniques to counter rising costs. Improved grease belts,[6] as operated in the Consolidated Diamond Mines of South-West Africa, have been described in *Optima.*

At the Koffiefontein mine, which was discovered in 1870, sampling operations on a large scale have been completed. It had been originally intended to re-open this mine to replace the Jagersfontein mine, but the present high rate of taxation does not make this economic, unless the sampling had yielded much higher values.

A. A. Linari-Linholm, in a paper presented to the Chemical, Metallurgical and Mining Society of South Africa, referred to the electrostatic methods for the recovery of diamonds as developed by the Diamond Research Laboratory, Johannesburg. This method is particularly useful for the recovery of the smaller alluvial diamonds. Models of new diamond recovery equipment, including heavy media separation plants, were shown at the Rhodes Centenary Exhibition in Bulawayo early in 1953.

Some good finds of alluvial occurrences[7] are reported near the Vaal River at Gong-Gong, and Nooitgedacht is improving. Of 114 claim holders, 89 sold diamonds totalling

The highly mechanized surface installation at the Premier Diamond Mine, near Pretoria



A view of the workings of the Consolidated Diamond Mines of South-West Africa, showing the removal of surface sands preparatory to extracting the diamondiferous beach deposits

846 ct. for the value of £8,613 15s. in October, 1953. Less good results are reported from Bloemhof, Schweizer Reneke, Christiana and Wolmaranstad. The best producer is Grasfontein. New ground has been given to diamond diggers at Bloemhof. The State alluvial diggings at Alexander Bay (Orange River) yield about 100,000 ct. a year, but the value has not been disclosed.[8]

"News from the Diggings" is an interesting monthly column in *Diamond News,* Kimberley. The biggest diamond to be found in the Mafeking district for some years was discovered some time ago by Mr. N. Kiebenberg. It weighed 15 ct. and its value is £900.[8]

An article reviewing the activities of the De Beers group appears on page 203.

Tanganyika. From the Mwadui mine, operated by Dr. J. T. Williamson, the installation of new plant is reported to be coming into operation about mid-1954. With this it is hoped to increase to 7,500 tons the quantity of diamondiferous gravel treated per 24 hours. To obtain additional water a new dam has been constructed to create a reservoir with a capacity of 1,800,000,000 gallons. The principal mining unit is a 6 cu. yd. electrically driven walking dragline.

The Tanganyika diamond exports during 1953 totalled 170,529 ct. against 331,344 ct. in the previous year. This latter figure was exceptionally high owing to the sales of accumulated stocks by the Williamson Diamond Mines after the dispute with the Diamond Sales Corporation.

Venezuela. Production for the first half year of 1953 in non-reserved areas reached 40,224 ct. valued at Bolivares 2,880,468 (1 Bolivar = $.30). In reserved areas production amounted to 4,477 ct. valued at Bs.248,956, giving a total production of 44,702 ct. Exports during the same period were 43,092 ct.

Some small occurrences were reported in Southern Rhodesia (48 ct. in 1952), and in Surinam (8.8 ct. in 1951). Some new, and as yet unconfirmed occurrences are reported from Kuwait on the Persian Gulf, and on Rainy River in north-west Ontario, Canada.

Diamond Stocks

Some interesting information on the stocks held by the diamond producers of the De Beers Group was given by Sir Ernest Oppenheimer at the annual general meeting of the De Beers Company in June, 1953. At the end of 1952 the total stock held by De Beers was only £311,947 valued at cost of production, and by the Consolidated Diamond Mines of South-West Africa only £414,055. The Diamond Corporation stock at the same date amounted to £5,782,832 valued at cost of purchase. Sir Ernest refuted the opinion held in some quarters that the diamond companies mine in such a way as to restrict production in order to cause an artificial shortage and keep the price of diamonds at unreasonably high levels. He said this view was contradicted by two important principles which operate in the diamond trade. Firstly, the selling arrangements contain provisions by which each producer is guaranteed that, however bad the general trade conditions are, his sales will not fall below an agreed minimum. As a result there is always continuity of production. Secondly, he said, the industry had always equipped its mines to operate at their optimum capacity.

Recent Reviews of the Industry

Well documented surveys of the diamond industry in 1952 are given by G. Switzer and W. F. Foshag, in English, in their yearly review in the *Jeweler's Circular Keystone*, as well as by A. Moulaert in French (*L'Industrie de Diamant, 1952*, Brussels). The section on industrial diamonds was relatively short in the Switzer-Foshag survey, but Moulaert devoted more space to it. These important reviews on 1953 will probably come out later in the year. An eight-page brochure on industrial diamonds[9] in 1953, the ninth successive report, has been prepared by the Industrial Diamond Information Bureau, which covers practically all tool applications, as well as other scientific aspects. More attention appears to have been given to certain new developments and approaches in the diamond industry. For example, in England three new diamond tool standards have been issued. Greater attention than hitherto has been given to the problems of improving diamond use, for instance by orientating the diamonds, and by salvage and recovery.

Work of the B.S.I.

In Great Britain the British Standards Institution issued the following new standards :[10]

B.S. 1987 : 1953, Classification of diamond powder in the sieve and sub-sieve ranges. This standard specifies the sizes and purity of diamond powders produced by sieving or other methods of classification. The sieve size range is subdivided in (a) wide grading and (b) close grading. It ranges from 12 to 300 mesh with nine ranges for wide grading and 19 ranges for close grading. Sub-sieve size powders, ranging from 0 to 60 micron are sub-divided into nine ranges, and tolerances indicated. Powders which comply with the standard shall be marked with the manufacturer's name or trade mark, the words "diamond powder," the size expressed in nominal B.S. sieve range or micron range, and the number of this British Standard. Licences for using the registered certification trade mark of the British Standards Institution are granted for products which comply with the specification.

B.S. 2002 : 1953, Dimensions of diamond trueing tools. This gives dimensions and tolerances for diamond trueing tools for grinding wheels and specifies the weight ranges of single diamonds to be used with each type of holder. The following holder diameters are fixed : $\frac{1}{4}$, $\frac{5}{16}$, $\frac{3}{8}$, $\frac{7}{16}$, $\frac{1}{2}$, $\frac{5}{8}$, and $\frac{3}{4}$ in., with specified lengths from 2, 4, or 6 in. For the weight range a minimum and a maximum is indicated. Besides plain cylindrical shanks, those with a head and one type of

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Morse taper shank are specified. Tolerances for the reception bores are given and further guidance for the selection of trueing tools and recommendations for their use and care are given.

B.S. 2064 : 1953, Dimensions for diamond abrasive wheels and tools. This standard is intentionally restricted to the dimensions. It lists the following types of wheels and tools : Peripheral wheels ; straight cup wheels ; double cup wheels ; taper cup wheels ; bull-nosed cup wheels ; dish wheels ; cut off wheels ; chip-breaker wheels ; milling tools (for the optical industry) ; hollow drills (for glass, ceramics, etc.) ; stone saws (diameters only) ; hones (hand operated). Recommendations for the marking is given, but no complex marking system applicable to all manufacturers could be established. No indications for the thickness of the diamond layer or the diamond concentration are given.

Two Valuable Conferences

During the last year two important conferences were held in England. A special Hardness Testing Conference[11] was held in Sheffield, October 13 to 15, 1953, organized by the Sheet and Strip Metal Users Technical Association, during which ten papers were presented by experts from England, Sweden, U.S.A. and Germany. This conference was connected with an exhibition in which the products of 12 producers of hardness testing equipment, including some research organizations, were exhibited.

The National Physical Laboratory, Metrology Division, recently arranged a four-day International Symposium on Dimensional Engineering Metrology, during which 40 papers were presented in the following sections : workshop inspection, pneumatic gauging, machine tool accuracy gear measurement, education, small scale measurement, large scale measurement and surface finish. The papers and discussions will be published in full in the near future ; extracts and surveys have already been published in journals such as *Machinery, Machinist* and *Industrial Diamond Review.*

Rock Drilling

A general survey of the various diamond tools used in the American mineral industries has been given by A. E. Long.[12] He demonstrated that at present only 8 per cent of the total amount of industrial diamonds imported into North America are used for drill bits, whereas in 1926 about 80 per cent of all industrial diamonds imported were used for that purpose.

Diamond drilling conferences were held at the University of Minnesota,[13] U.S.A., and in Melbourne, Australia, the latter being arranged by Mineral Drillers Ltd. The proceedings of this latter conference[14] and those of the conference held in Johannesburg, South Africa,[15] in 1952, have now been published.

Progress on the casting of drill bits[16] and orientated drill bits was reported. In previous years investigations on this subject were mainly confined to academic questions, but now certain manufacturers, notably Sprague and Henwood, seem to have taken this up commercially, and good results have been reported.[17] E. P. Pfleider investigated the use of cube-shaped natural diamonds[18] instead of octahedrons for drill bits and reports some very good results. The only investigation previously carried out on this subject was by the Diamond Research Laboratory, Johannesburg. R. J. Miller carried out an interesting study on the distribution of diamonds in a drill bit, and the influence of diamonds in the range of 10 to 100 stones per ct.; a condensed extract of this has been published in an English journal.[19] A new double-acting drill bit[20] has been described, as well as a stepped drill bit which produces relatively large debris.[21] A German-English dictionary on deep drilling technique has been issued.[22]

It is now more or less common practice to use finely graded diamond powder for metallographic polishing, but to an increased extent sawing blades, diamond grinding wheels and also loose diamond powder are being used for preparing polished section of ores and mill products.[23]

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(10) Copies are available from the Sales Dept., British Standards Institution, 2 Park Street, London, W.1.

(11) See for instance *Ind. Diamond Review,* 1954, Vol. 14, pp. 6-9, pp. 34-36, 38.

(12) *Ind. Diamond Rev.,* 1953, Vol. 13, pp. 29-32.

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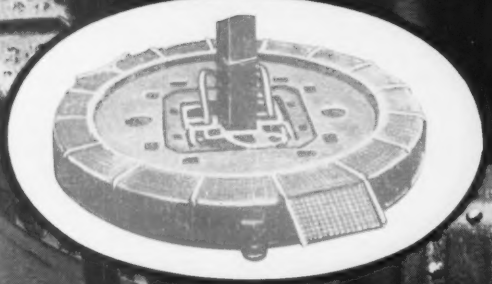

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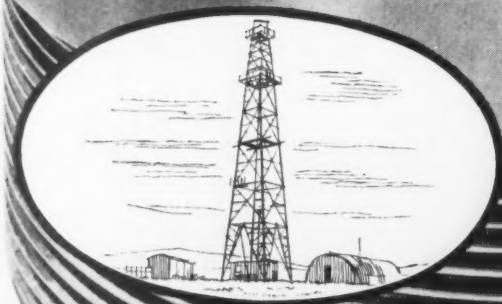

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Mineral Exploration

By G. A. SCHNELLMANN, Ph.D., A.R.S.M., M.I.M.M.

AN American, the vice-president in charge of exploration of a large corporation, who visited England during the summer, made an interesting appraisal of activity in this field which serves as an admirable preface to this review. The vertical company structure so much favoured in the U.S.A., he asserted, tends all too frequently to put policy-making decisions into the hands of men who are primarily smelters, sales promoters, and the like and who have insufficient appreciation of the vital importance of discovering new orebodies.

Rather than spend money on this admittedly speculative business, they keep it in reserve in the belief, or at least the ardent hope, that a mine will come on to the market about the time one of theirs is due for exhaustion. He compared the attitude of British mining companies to exploration very favourably; they, he asserted, are fully alive to the fact that the only sure way to continue in the mining business is to go out and look for mineral deposits, creating mines from them when found. This perhaps surprising but very refreshing analysis comes from one who can fairly be said to know what he is talking about, and gets some factual support from the increasing activity of British mining houses in North America.

The past year has indeed been one of vigorous activity in mineral exploration all over the world. Prospecting has been sponsored not only by private enterprise but also by governments anxious to assess their mineral wealth. Two such nation-wide appraisals were commenced in the Midd'e East, the one in Jordan and the other in Iraq. Apart from the oil in the latter country, neither of these nations has had an important mineral industry in modern times, although the ancients are known to have worked certain of the base metals. The outcome will therefore be particularly interesting. A third such survey, reported to be planned by Ethiopia, has not yet materialized, but is said still to be under active discussion.

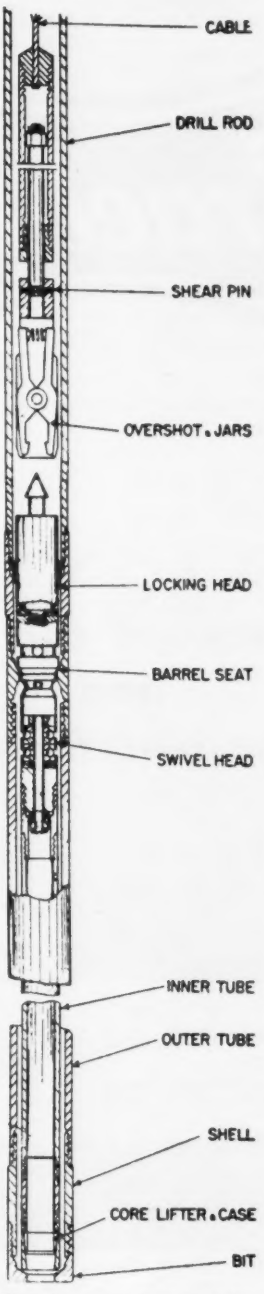
The New Economic Mineralogy

Perhaps one of the most striking features of contemporary mineral exploration is not so much the search for new deposits of the familiar base metal ores—cassiterite, galena, chalcopyrite, etc.—as the advent of what may be called the new economic mineralogy. Minerals which, if previously known at all, were regarded only as scientific curiosities, now assume major economic interest. This, in turn, arises from the importance of metals formerly of no engineering interest.

Pyrochlore and ilmenorutile, potential ores of niobium, are two cases in point. Concerning the first-named, Uganda reported the world's first proved deposits of 200,000,000 tons of ore, capable of producing 1,000,000 lb. of niobium pentoxide p.a.

Tanganyika announced the discovery of important deposits of another unfamiliar mineral, orthite, of value for its hafnium content. This metal, with others of the rare earth group, is used in the cold valves which are becoming increasingly important in modern electronic circuits.

Another of them, germanium, has been recovered from flue dusts, and some coal seams are now being systematically sampled for it with the object of burning the germanium-rich portions in special furnaces. Coal as a metallic ore is indeed an unfamiliar concept!



Wire line core barrel equipment **(see page 69)**

Uranium Discoveries

Among the more familiar, if only recently utilitarian metals, uranium has continued to command attention. Announcements of new discoveries, particularly in Australia, have been made with almost monotonous regularity. Most of these reports in fact refer only to the detection of radioactive anomalies, as often as not by scintillometer, as the airborne Geiger counter is called. One rarely reads of any subsequent attempt at full and detailed assessment, but it was announced after the turn of the year that one of the larger London mining houses is to take a hand in developing the Rum Jungle field.

From Brazil came the announcement of deposits of djalmaite, an oxide of uranium and tantalum, in association with cassiterite, another example of the new economic mineralogy. According to one statement, these deposits may contain from 2 to 10 per cent uranium.

By and large, however, uranium is an outstanding example of the creation rather than the discovery of orebodies. The Rand gold ores are also uranium ores, since the latter metal developed a use, and additional recovery plants have been, or are about to be, put into operation.

Iron Ore and Ferro-Alloy Metals

On the whole, iron ore has been the feature of the year. Concentrates were prepared from taconite, another instance of the creation of orebodies from sub-economic material by processing. First shipments of ore were made from Conakry (French Guinea), from Peru and from Venezuela. New deposits discovered in Algeria, and in British Guiana, were estimated to amount to 600,000,000 and 46,000,000 tons respectively. Other discoveries were made in Pakistan and Portuguese India but no assessment of them was published. There is now a strong feeling in some quarters that the post-war discoveries of iron ore fields (or more accurately, the assessment and development of deposits long known but previously uneconomic) have now established a glut of this material. This does not seem to act as a deterrent to further exploration, however. Assessment is continuing of the deposits at Fort Gouraud, in Mauritania, and plans are afoot for developing others in West Africa and South America. All these new ores are

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high-grade haematites, and a further geological feature which they have in common is their association with, and possible derivation from, banded haematite-quartzites or jaspers of great geological antiquity.

Ferro-alloy minerals also made news. In Cuba a nickel-cobalt orebody estimated to contain 40,000,000 tons of ore was discovered, and a nickel-cobalt-copper vein discovered by drilling in Alaska was confirmed by tunnelling. Chromite was found at Kharan in Pakistan. In a comprehensive report covering the results of a special geological survey which has been in progress since the beginning of 1952, this country also announced the discovery of bauxite at Azad Kashmir and of rich, but unspecified, copper ores north of Fort Sandeman.

Its major mineral discovery, however, was that of the natural gas field in Baluchistan. It is already being developed, and the 150-mile pipeline is expected to deliver this valuable fuel in Karachi by mid-1955.

Another opportune discovery of mineral fuel was that of a seam of coal 2 to 3 metres thick and of excellent quality in Northern Rhodesia ; opportune, because of its proximity to the fuel-starved Copperbelt.

Lead Reserves Still Precarious

Lead is still the base metal giving most cause for concern. The position with regard to it suffered one setback and made one gain during the year, but on balance the world ore-reserve position has probably improved. The setback, which may eventually prove only to have been partial and temporary, was the announcement from Denmark that the lead deposits in Greenland had proved on development to be considerably less than expected. No precise figures were published with this statement, but it will be recalled that some of the earliest reports of the deposit spoke of indications of 1,000,000 tons of lead metal. It is understood that development is continuing.

A happier lead story came from Canada, where drilling based on a geophysical survey in New Brunswick located an important orebody. One borehole intersection was reported to assay 4.5 per cent lead, 11.5 per cent zinc, and 3.8 oz. of silver per ton over a length of 201 ft., but it was not stated whether this represents a true thickness. Later reports said that a spectrographic analysis of the core had also revealed the presence of tin and tungsten. This unusual association recalls the Sullivan mine in British Columbia, which has for many years been successfully recovering the minute amount of tin present in its ore, and is of particular interest in a continent notoriously deficient in tin.

A Development in Submarine Geophysics

An interesting experiment in submarine geophysics was initiated during the year. Submarine geophysics is not in itself a novelty, of course. Seismic surveys have been made from ships for many years past, and the work of the Dutch physicist, Venning Meinesz, on gravity values in the seas surrounding the Dutch East Indies is well known. Meinesz made his observations in a submarine, using an ultra-sensitive pendulum. His object was purely scientific, but it is impossible to know at what stage fundamental research becomes applied research, and off-shore oilfields were bound to call for a technique which could be operated from a floating or a submerged vessel.

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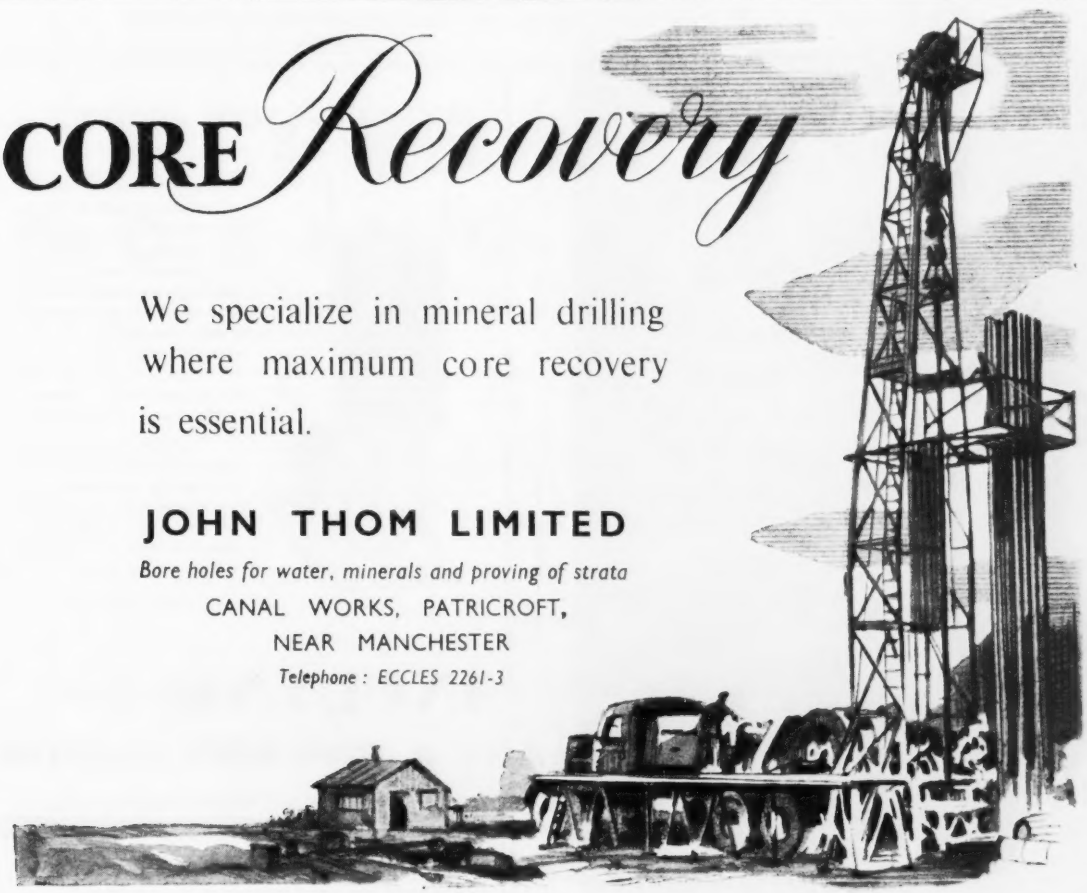

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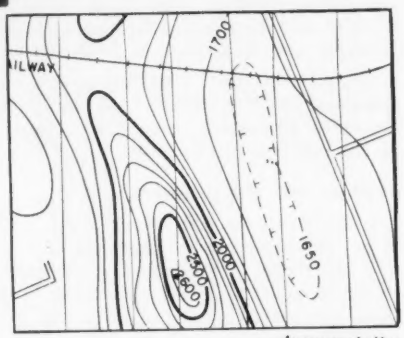

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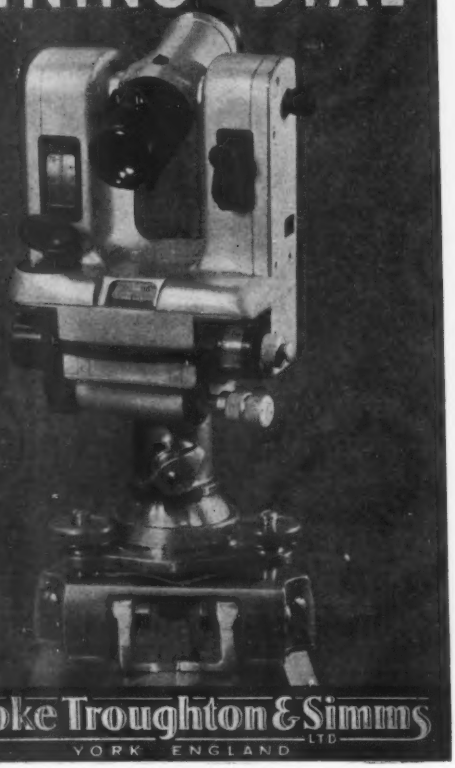

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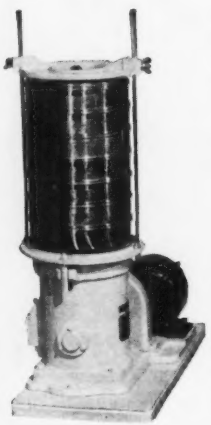

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consuming pendulum for the observation of gravity data. It is not known if the experiments have been completed, but at the time of going to press no results have been published. The gravimetric method is not one which has a wide field of application in mining problems, but there seems no reason why the seismic method operated from a ship could not be applied to the elucidation of the structure and extent of those British coalfields which are known to extend under the sea.

Increasing Use of Geochemistry

Striking testimony was borne to the interest in geochemical prospecting by a course held at the Royal School of Mines in September. More than 50 senior executives attended the lectures and demonstrations. They had come from almost every corner of the Commonwealth, as well as from several foreign countries, and were representative of every branch of the mining world, from geological surveys through consultants and contractors to producing mines. There seems to be developing two schools of thought among the practitioners of this art, the one using the techniques on a qualitative basis and the other on a quantitative basis. It is rather to be hoped that the latter prevails, for such words as faint, intense, high, medium, low, are essentially subjective, whereas " parts per million " enables a comparison to be made from place to place.

Figures, moreover, can be subjected to statistical analysis, which should be able to answer the sometimes difficult question, when is an anomaly not an anomaly? A good deal of valuable case history has accumulated by now, but it is rather surprising that there is so little attempt to use geochemistry and geophysics in conjunction. These are complementary methods, and in the case, for example, where a geophysical survey had located an electrically conductive body, a geochemical examination might decide whether it were an orebody or an unmineralized fault gouge.

Two Interesting Drill Accessories

Two interesting new accessories have been developed during the year: a wire-line core-barrel (illustrated on page 65), and a borehole camera.

The wire-line barrel has been used in oil-drilling for many years, and is primarily a time-saving device. In standard drilling practice the necessary rotary motion is transferred from the power unit to the cutting tool at the bottom of the hole through a jointed string of hollow rods, through which also the circulating fluid is pumped. Additional joints of drill rod are added as the hole deepens and, what is more to the immediate point, when it is desired to recover the core-barrel, the whole drilling string has to be removed from the hole and disconnected, to be re-assembled before drilling can be resumed.

The loss of time involved in this operation, especially in a deep hole, is apparent, and it is scarcely surprising that designers gave some attention to the possibility of making a core-barrel which could be detached from the main string and hoisted from the hole independently. This was achieved with comparative ease, but none the less with ingenuity, in oil-well equipment which has larger sizes and clearances than diamond drilling equipment.

Ignoring mechanical details, the core-barrel is lowered through the drill rods on a steel cable and is fitted with a locking device which connects it with the main assembly at the bottom end. The cable is backed off during the actual drilling operations, but has a recovering device, known as an overshot, at its lower end. When the barrel is to be removed, the overshot is lowered to engage with the upper end of the barrel, the locking device on which is automatically released, and the barrel is hoisted to the surface without disturbing the main string of rods. It will be apparent from this brief description of the way in which

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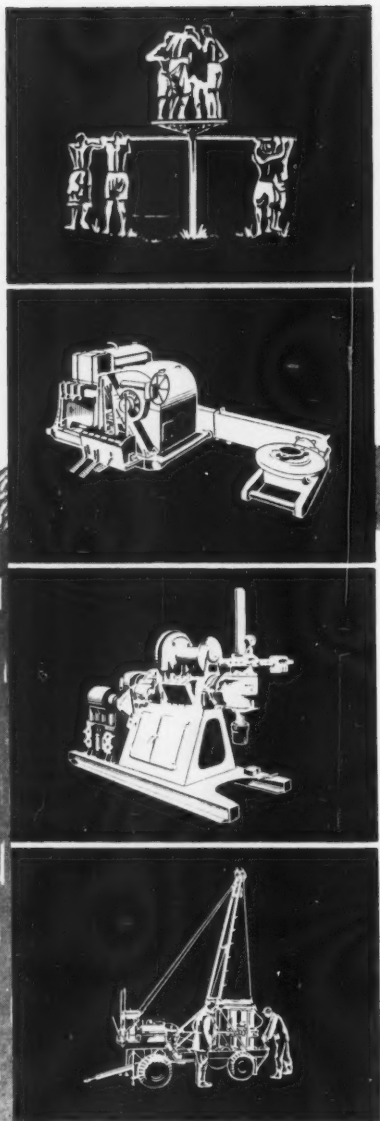

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the wire-line barrel works that the core can only represent a small central portion of the total area of the hole.

The mechanical difficulty of adapting the device to diamond-drilling equipment also calls for little comment. It has, however, now been achieved by a well-known specialist firm of drill manufacturers and contractors, who claim to have used the drill successfully on BX (2⅛ in. diameter) holes ranging from 500 to 3,200 ft. in depth. By saving time this new accessory should also save money, so reducing the cost of drilling and contributing to the cheapening of this expensive business of exploration.

The Borehole Camera

The borehole camera is also a triumph of design. It has been developed by the Corps of Engineers (Geology and Geophysics Branch) of the United States Army for use in NX (3 in. diameter) holes, and is claimed to give a "continuous undistorted cylindrical" colour picture of the walls of a borehole, regardless of whether it is dry or filled with water. It uses 16 mm. film, photographing 1 in. length of hole at each flash, and making 16 exposures per ft. of hole, so that sufficient overlap is obtained for correlation from picture to picture. The pictures have to be used in conjunction with a special projector which rectifies them into true scale images. A compass in the camera is visible in each picture, thereby making possible the correct orientation of the projection on the cylindrical screen.

Such an instrument cannot, of course, eliminate the need for core-drilling in order to obtain samples for assay, but even in this connection could be invaluable in explaining poor core recovery. Its main field of potential use in exploration drilling is, however, in the provision of structural data, correctly oriented. This has so far only been possible by the difficult technique of recovering an oriented core.

New Thinking on Geological Fundamentals

While this article is not intended as a review of progress in pure science, some brief reference to fundamentals is justifiable on the ground that the scientific curiosity of to-day may prove the basis of the industrial commonplace of to-morrow, as witness the new economic mineralogy. Dr. G. M. Lees, in his presidential address to the Geological Society, cast very considerable doubts on currently accepted ideas of the earth's internal constitution and structure, and reverted to the idea of a shrinking earth as the cause of mountain structures. He thought that geologists had been too modest and too ready to believe in the infallibility of the geophysicists' arguments.

Touching closely, as they did, on matters which bear on conceptions of ore-genesis, Dr. Lees's arguments might have been expected to call for some modifications of ideas on this subject. That they did not in fact do so is a measure of the empirical basis of the present state of our knowledge of the materials with which the mining geologist deals.

The attempt to replace empiricism by rational arguments is continually going on, however, and Professor Gordon Smith reviewed the physico-chemical data relating to fluids above their critical temperatures, which are often invoked as agents of ore-deposition. His conclusions give no reason for abandoning this view.

In the field of laboratory technique, based on fundamental physical measurements, new data came forward from the University of Wisconsin bearing on the optical properties of certain of the opaque ore-minerals. Polarization figures and rotation properties were investigated and shown to be a valuable new aid in the identification of certain cobalt, nickel and iron sulpharsenides which were previously difficult to distinguish by standard methods.

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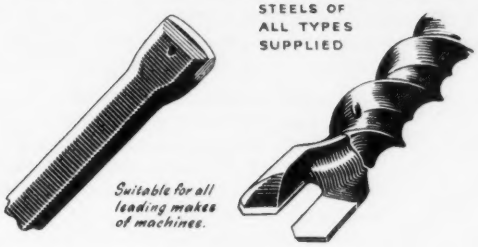

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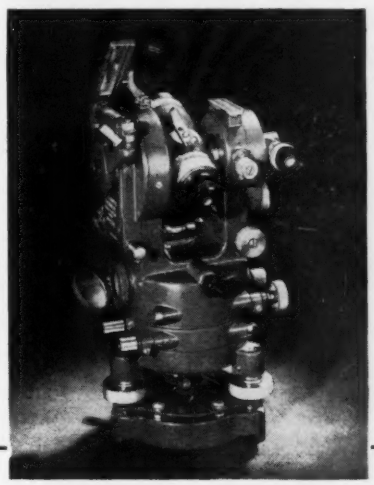

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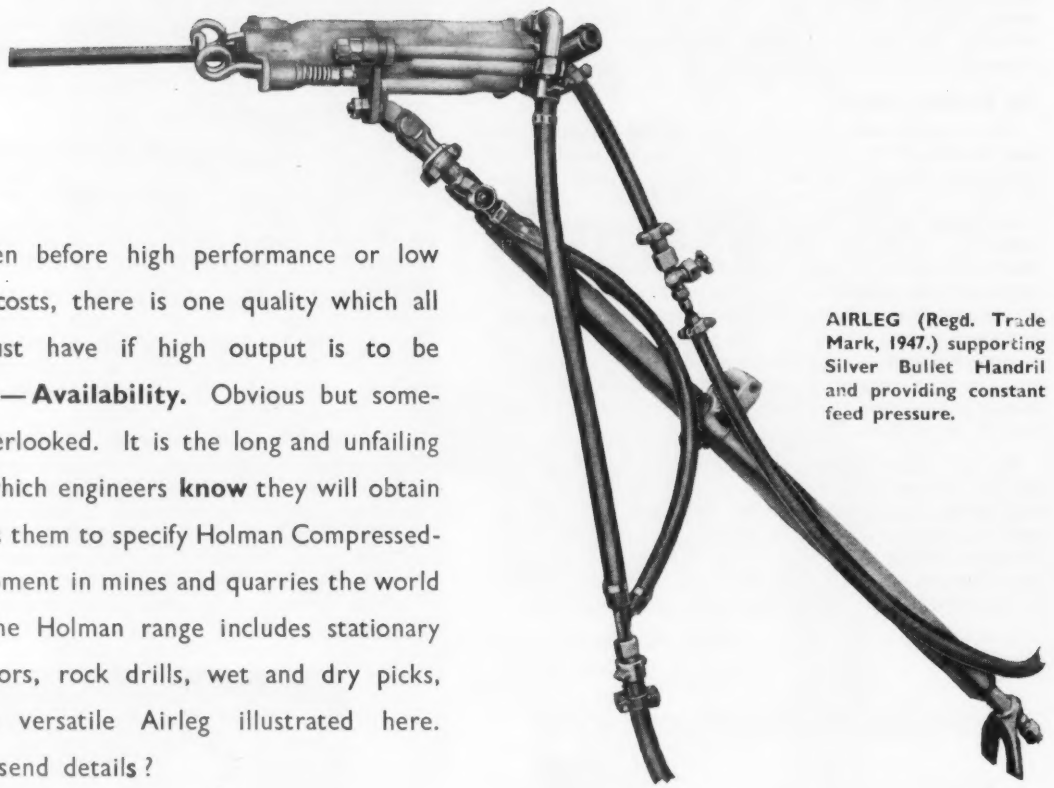

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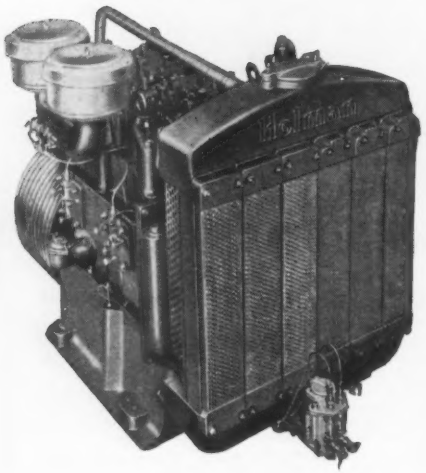

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Metal Mining Developments

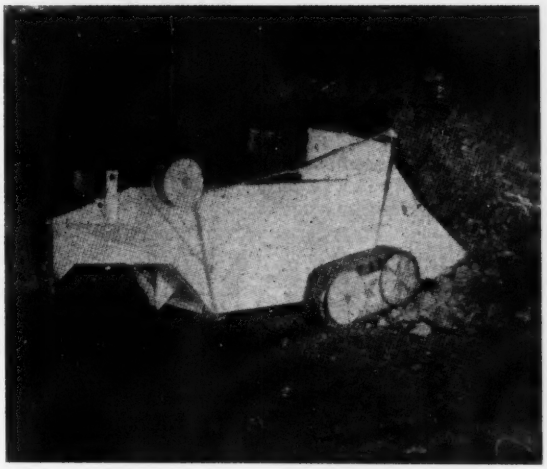
By J. B. RICHARDSON, A.R.S.M., M.I.M.M.

THE main overall trend during the past year would appear to be higher efficiency in mining rather than increased output. Because of the shortage of labour in South Africa, where some mines are down to two-thirds of their requirements, mechanization is increasing.

Generally there has been an extension in the use of tungsten carbide insert bits. In short blastholes the tendency is to drill holes of lesser diameter and in long blastholes the opposite trend is to drill larger diameter holes in order to increase the explosive charge. In mining areas where their use is well-established, the single use bit continues to be favoured. Successful experiments are reported in replacing percussion drills by rotary drills in boring medium-hard rock.

In blasting, ignitor cord is receiving attention as a safe, cheap method of firing a round in any kind of development heading. Ingenious methods have been devised for reducing the time spent in loading broken rock in tunnels and drifts.

Drilling, blasting and loading are still the special preoccupations of the metal mining engineer, who seems unlikely to be provided with a universal mining machine for excavating the harder rocks in the foreseeable future. He is, however, now provided with a wider choice of equipment than ever before for all three operations.



The Hayes Gizmo
(*Photo from "Mining Engineering"*)

Drilling Methods

As well as the hardness of the rock to be broken, the method of mining influences the choice of drilling equipment. Where a ring of blastholes is to be drilled, whether in sub level caving, open stoping with long hole drilling, pillar recovery or like operations, there is a tendency to prefer the long-feed two-drill jumbo with which one man can drill 250 ft. or more within the drilling shift. But this type of machine is naturally only adopted where the drillers are highly skilled. On the other hand long holes are being successfully drilled by light push feed drills.

A current use for light jackhammers with pneumatic legs is in underground exploratory work, drilling 50 ft. holes at any angle to test assay walls, the continuance of lodes or testing for water ahead of development headings. With $\frac{7}{8}$ in. hexagon rods, holes up to 100 ft. are reported and 200 ft. holes have been drilled in exceptionally favourable ground, so that in some mines this has led wholly or in part to the replacement of diamond drills for the same purpose.

According to a research organization the greatest promise in exploratory drilling with percussion drills is with high frequency drilling of 300 cycles a sec. and a corresponding low amplitude generated by a magnetostrictive device in the bottom of the hole supplied with A.C. current.

Long Hole Drilling

The high cost of diamonds has further encouraged the use of percussion drills in long blasthole drilling. As against the trend, already mentioned, towards reducing the size of holes in short hole drilling, the trend in long hole drilling is to increase the diameter of the hole up to $2\frac{1}{2}$ in. This means the use of heavier machines. The study of couplings for jointed rods and the need for some form of jointed rods with flush couplings with hollow steel rods continues.

At Sudbury 4 in. drills with a special feed motor with neutral and reverse rotation, a 6 ft. shell and a sturdy sliding centralizer are used for drilling long blastholes with 4 ft. jointed rods of alloy steel and four-point carbide insert bits of $2\frac{1}{16}$ in. to $2\frac{1}{8}$ in. diameter. Upholes are drilled 60 ft. long and downholes 120 ft. The increase in the size of hole from $1\frac{7}{8}$ in. enables the explosive charge to be 36 per cent greater, with the consequent advantage that the rock breaks finer.

At the Sigma Gold Mines flexible oblong section steel as developed by Sandviken in Sweden is used up to 24 ft. in length with air leg machines. The same steel is in current use in the iron ore mines of Sweden where long holes are drilled from stope drifts with little headroom. There, by means of a curved steel clip, the long but flexible steel is easily drawn out of the hole even in a narrow opening.

In those mines were special chambers have to be excavated for setting up diamond drills, the use of light percussion drills with air legs requires less excavation for the smaller rig, and also less gear.

Dry Drilling

Holman's Dryductor is undergoing thorough trials in several parts of the world and merits attention where the dust menace is serious or where the nature of the ground demands dry drilling, as in the South African diamond mines. A recent paper on a new method of illuminating dust of dangerous sizes arising from rock drilling makes it clear that this machine is superior in preventing the formation of dust, with the vented drill as used on the Rand a second best.

A Driller-Loader-Haulage Unit

An all-purposes machine evolved from a drill jumbo is the Hayes Gizmo which acts as a drill carriage, a loader and a haulage unit as well. It is operated by an Allis Chalmers caterpillar tractor and has been in use for two years during which time one machine has handled nearly 211,000 tons. Normally two of these machines are in use, one mounting from three to five drills and the other acting as a loading and haulage unit. The two machines drill, load and haul from 700 to 750 tons a day. The drilling efficiency reached 122 tons per man shift and for the entire crew employed on stoping gave a figure of 35.25 tons per man.

Air Leg versus Drifter

The Canadian *Mining and Metallurgical Bulletin* of October, 1953, compares air leg supported drills with drifters at some length, and in the U.S.A. air legs continue to replace mounted machines with the trend towards $\frac{1}{4}$ in.

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steel to drill more footage per man shift with still smaller diameter holes. It produces, however, a problem for the explosives engineer so that the future of rock drilling seems to lie between the steel maker and the explosives manufacturer.

Rotary Drilling

In the Birmingham district of the U.S.A. tests were made in drilling with an electrically driven rotary drill in both limestone and semi-hard ore with holes up to 1⅛ in. diameter. Penetration rates were obtained varying from 3 ft. to 9 ft. a min. with several different types of tungsten carbide cutting bits. An electric rotary drill made by Victor Products (Wallsend) Ltd. underwent severe tests in Norway and in medium to hard limestone had a faster rate of penetration than a 40 lb. normal jackhammer. The 50 cycle heavy duty drill was mounted on a feed bar fixed on a steel column fed by a ratchet operated force feed mechanism with 1 11/16 in. bits on diamond section rods at speeds of 120 and 410 r.p.m. Penetration was 12 in. to 16 in. a min. as against the 11 in. obtained with the jackhammer.

Choice of Drill Bits

There is little doubt that both in British mines overseas and in North America, tungsten carbide bits used in conjunction with an air leg supported light jackhammer are becoming more generally used, and there is a distinct trend to drill holes of a lesser diameter in both cases in small sized development headings thus enabling the use of lighter and more mobile equipment. In the case of British mines where native labour does the drilling the same equipment is used even when the headings are not so small.

The P.M. and Throwaway bits are apparently not losing favour in those fields where their use has become established practice, although the consumption of P.M. bits on the Rand has been reduced to 84/90 per cent of former rate of consumption because they can be successfully reground for a second use. In the South African mines integral tungsten carbide tipped alloy steels are also used at a rate of over 1,000,000 a year according to one authority.

The multi-use detachable steel bit continues to be used in softer ground or in those sections of mines where the ground is soft enough to justify their use and where the change to the more expensive tungsten carbide bit would be uneconomic.

Varying Life of Insert and Drill Rod

A drawback to the carbide tipped alloy steel is the difference in life between the insert and the rod itself. In many tough, fine-grained hard rocks the insert is worn out before the rod. Brazing in new inserts is an expert job, but a number of mines from British Columbia to Kolar are undertaking this work and report success, claiming a considerable cost reduction, which in some cases is halving the cost of steel and bit and is obtaining as long a life as from steels bought direct from the manufacturer.

At Mascot the problem was whether to buy or make tipped steels that would give a cost of 2 c. or under for a ft. drilled in the uniformly hard rock. The first combination of 1 in. carbon steel with Kennemetal inserts was not a success, as the steels failed near both ends and the costs were higher than the required figure, but in the autumn of last year the use of ⅞ in. Double Diamond alloy steel, step annealed and carefully heat treated, was begun. This gave a satisfactory penetration speed at a cost of under the 2 c. per ft.

When the insert outlives the rod a different problem is presented. As mentioned in these columns last year welding of pieces of alloy steel to re-form rods of suitable length was tried out at a Canadian mine. Whether this practice has extended is not apparent as there do not seem to be fresh reports on the matter.

Clearance for Chippings

The Sheffield firm of Padley and Venables have developed a three-wing bit to give greater clearance for chippings, especially useful when there is little difference between the diameter of the rod and the diameter of the bit. It is claimed that under proper circumstances faster and deeper drilling can be obtained than with the standard four-point bit.

A new type of detachable bit with spiral ridges is reported with the same spiral pattern repeated on the extension rods. The spiral starts just below the cutting edges of the bit with a groove deeper than usual between the edges to permit the free passage of large chippings. It is claimed that the cuttings are screwed rapidly away from the bit and binding is obviated.

In development, when the burn cut is used, it is common practice to drill the central uncharged holes 2½ in. or 3 in. in diameter, usually with the same light machine used in drilling the rest of the round. In the U.S.A. it is reported that in using the burn cut a central hole as large as 8 in. diameter has been experimentally used in limestone and semi-hard iron ore. Average penetration was 4½ in. per min., the central hole being drilled by a compressed-air-driven rotary drill. By means of this large central hole it was possible to repeatedly advance 16 ft. instead of 7½ ft. in headings 12 ft. by 22 ft.

Blasting Practice

An innovation and an economy in blasting is the introduction of ignitor cord for the initiation of development rounds. It is now the standard method of lighting safety fuses in headings at the mines of International Nickel and has proved safer and more efficient than other methods of lighting. From the blaster's point of view the great advantage is that instead of lighting 30 or 40 fuses he has only to stay at the face for the time required to light a single fuse. It also enables the fuses to be lit in the desired order, as the intervals between the lighting of the safety fuses can be sufficiently increased to assure detonation in the required sequence. It is much cheaper than electric detonators and claims the same degree of safety. In the account giving the details of procedure at Inco's mines it is laid down that all holes must be tamped with clay stemming.

Stemming techniques do not attract the same attention in metal mines as in coal mines, where there is the hazard of gas and dust explosions and all holes must be stemmed to the mouth. Yet in metal mines there is much more explosive used for each ton of ore broken. Nevertheless, many of the largest and best conducted metal mines use no stemming at all, or the use of it is left entirely to the driller's discretion. Paper only or moist clay that is extruded out of the hole like a projectile on blasting is in common use.

There is no lack of technical information on the subject, and for many years technical reports have advised the use of dry, gritty, material as the best form of stemming, giving economies of ten per cent or more in explosive consumption. The notable and lengthy experiments carried out over a period of five years by the U.S. Bureau of Mines at Mt. Weather in the 1940's proved conclusively the advantages of dry sand stemming, as did earlier researches made in this country.

In lode breccias with a number of rocks of varying hardness it is not easy to measure the optimum amount of explosive required to break the ground and the tendency is to use enough to make sure of breaking the round and avoid misfires with the consequent delays in production involved, quite apart from the additional hazard.

Service departments of explosive manufacturers have devised means of getting the same blasting efficiency with the smaller diameter blastholes. This is gained by the use of more powerful explosives and better spacing in the holes, but sometimes it is necessary to re-design the round

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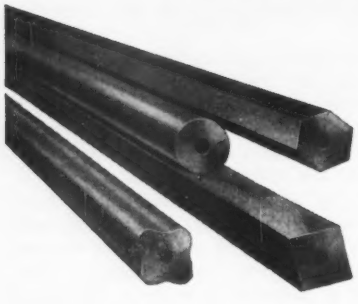

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without, however, either detracting from the advantages gained by drilling the smaller hole or sensibly increasing the drilling time.

Blasting Research by the U.S. Bureau of Mines

Interesting blasting research was reported in April of last year by the U.S. Bureau of Mines. From work carried out at their oil shale mine, the indications were that there is a maximum diameter drill hole that can be used for any given size of opening, type of explosive and rock. Tests with explosives of various strengths showed that 90 per cent gelatin broke the greatest tonnage of rock per lb. of explosive but that 45 per cent semi-gelatin is the most economical explosive, taking into consideration explosive cost and tonnage broken only.

In blastholes so loaded that the greatest energy is concentrated at the bottom of the hole and in decreasing amounts above the bottom, the explosive loaded in the longer hole will be more effective than that loaded in the shorter hole. The peak strain of the longitudinal elastic wave initiated in the rock after detonation increases with the size of the charge and decreases with the distance of travel. Under normal circumstances the elastic wave may crack the rock but it is probably the gas pressure that moves the rock from the face.

Blastholes on detonating give a definite time lag between the first detonation and the initial movement of rock from the nearest free face, this period may be from 15 to 40 milliseconds and its length depends on many factors. Better fragmentation and less consumption of explosive result from the use of short delay detonators whether in development headings or benches in stopes. Delay period between detonation in adjacent holes is the important factor for obtaining optimum fragmentation and maximum break with least explosive. Indications are that 12 milliseconds between holes produces best results in single row bench rounds in the particular rock studied. It would vary with other rocks. To get maximum efficiency in breaking large heading rounds where more than five rows of holes are blasted in sequence, short delays with longer delay periods than those at present made would appear to be desirable.

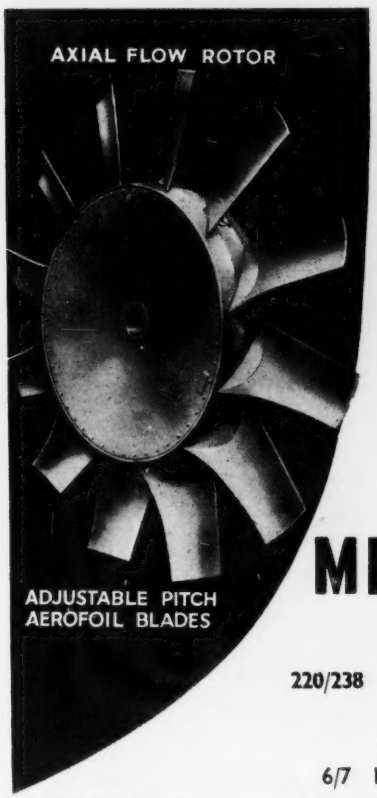
Slabs of explosives of 5 to 10 lb. weight are being manufactured for unchoking finger raises, chutes and ore passes. The special pack claims to be more compact than any bundle of cartridges and gives closer adhesion to the rock surface to be broken. There has also been a revival of interest in the use of shaped charges for secondary blasting.

Another research at Mt. Weather indicates that the no-cut round in raises using short delays is as effective as normal wedge cut rounds and gives better fragmentation but breaks more timber.

At a mine where short delays were introduced to blast rings of holes in sub level stoping after using 18,000 lb. of explosives initiated by that means, there was no damage and a minimum of vibration.

Timber Preservation

Because of the fact that timber is becoming increasingly expensive more attention is being given to the diseases that attack mine timbers and their treatment. The study of destructive fungi in the research laboratories of the Transvaal and Orange Free State Chamber of Mines has created a library of information on the many types of fungus investigated. Under highly adverse conditions of over 80 deg. F. and 100 per cent humidity untreated timber would only last a few months whereas the same timber after treatment would last as many years. Since 1932 some 3,000 specimens of fungi have been collected and examined, some of them by sub-cultures having been kept alive from that time.



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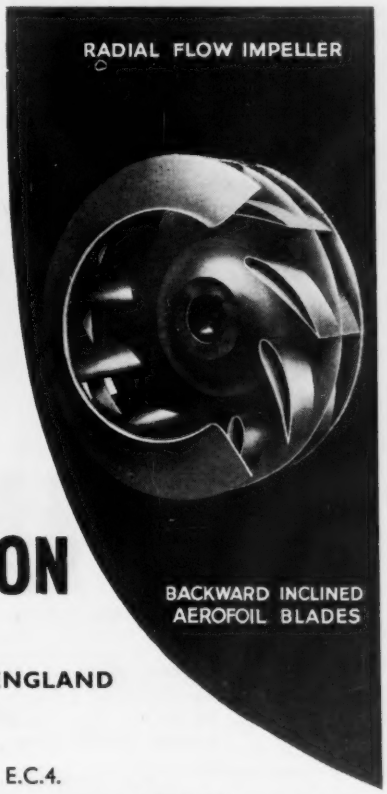

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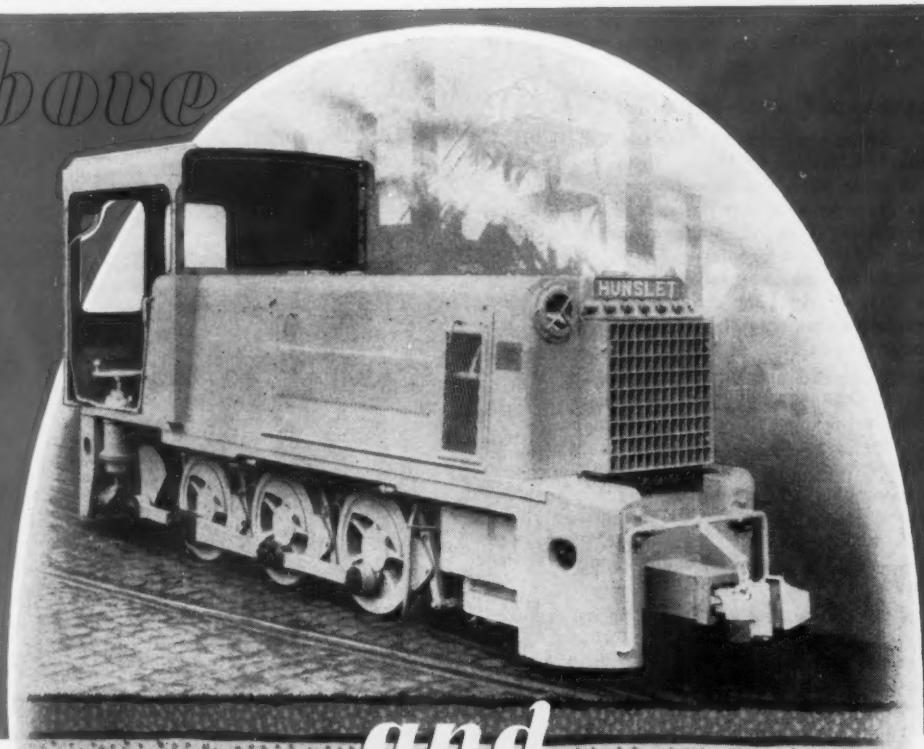

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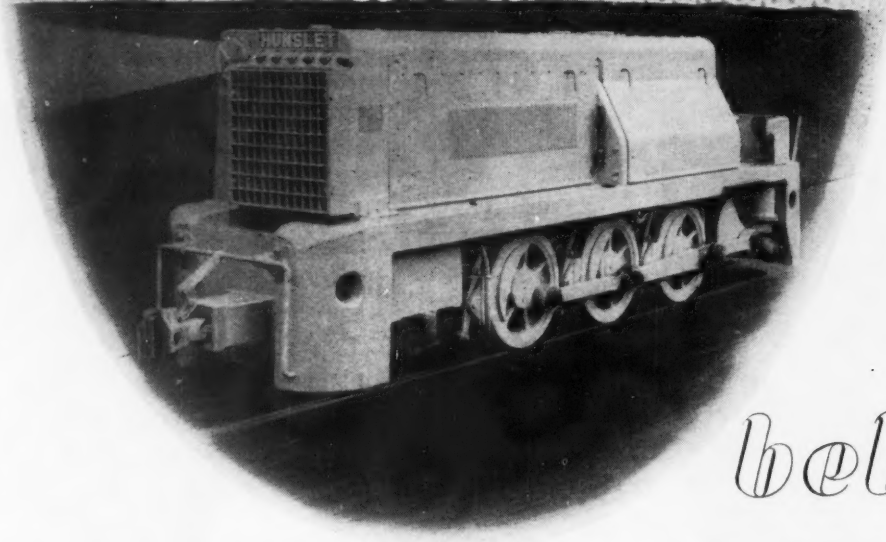

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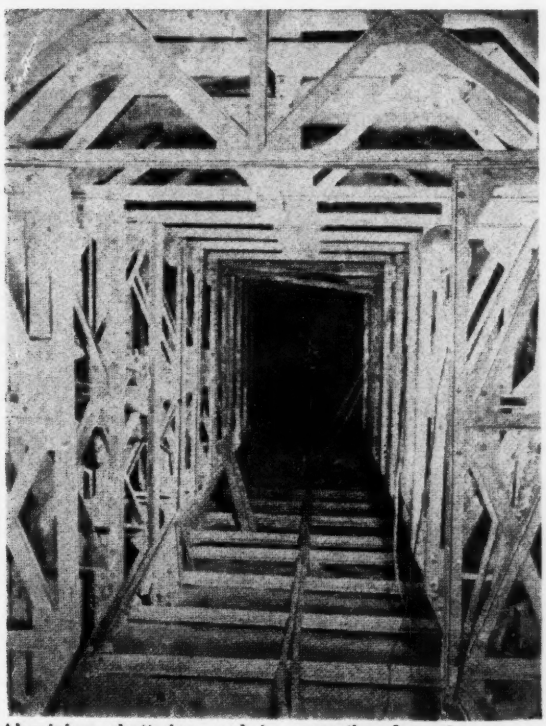
Methods of mine timber preservation vary from pressure injection of liquids of the creosote type to chemical pickling. Impregnation with solution of copper and zinc sulphates or with arsenates is commonly used, the latter especially in Scandinavia where they are used for all sorts of timber structures.

More recently there has been work on rendering mine timber more resistent to fire, a matter of great importance in heavily timbered dry mines. Coatings of sodium silicate and ammonium phosphate are used, also mixtures of sodium silicate and calcium sulphate. Urea formaldehyde resins and vermiculite are useful, and also on occasion common whitewash and cement. The general effect to aim at is to cause the coating, on being heated, to form a fireproof layer on the timber and thus reduce the fire risk, or at least delay the combustion of the timber.

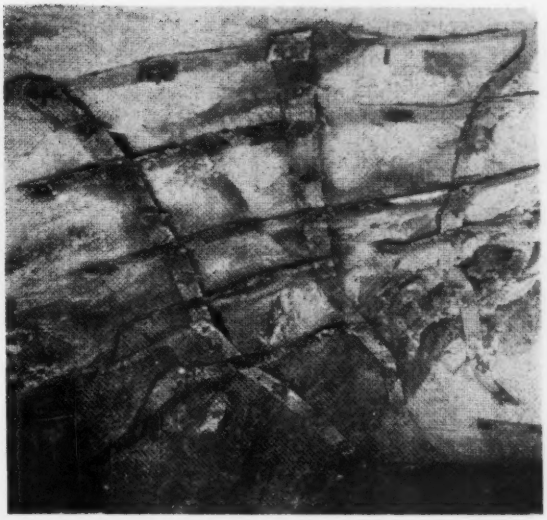
Roof Bolting

To avoid the use of timber, roof bolting is spreading steadily into metal mining practice. The advantages are obvious, especially where there is congestion or such operations as scraper-loading which was previously impeded by timber supports. Not only is greater freedom of movement provided in headings or stopes, but more room is available for storage and there is better visibility and improved ventilation. Roof bolts are used for two distinct purposes ; (1) to rivet together the edges of slabs of rock so that they behave as one piece and maintain a solid roof overhead in much the same way that thin broken china can be rivetted for re-use ; (2) to pin loose pieces of slabby or chunky rock to more solid formations above or behind them. In some cases the pinned rocks are sewn together with thin wire rope or laced with steel strips.

In Norway a combination of grouting and tying the rocks together with wire rope is in use. When acid waters make the use of steel bolts difficult wooden bolts can be successfully used and 4 ft. bolts of wood, with wedges top and bottom to secure them in place, have been employed.



Aluminium shuttering used in concreting for mine support
(Photo from "Mining Engineering")



Roof lacing
(Photo from "World Mining")

New steel bolts with wedge head and expansion shield instead of the split end bolts driven on to a steel wedge have been introduced. Made of $\frac{1}{2}$ in. carbon steel, these bolts, it is claimed, were not pulled out under an 18 ton strain whereas the older type pulled out at a 2 ton pull.

In dry dusty mines the drilling of holes for roof bolting in development roads has been accomplished without causing any dust nuisance by the Holman Dryductor.

Roof bolting, rock sewing, or the support of open spaces in mines without the use of vertical timber or steel has now been successfully applied to hard and soft rocks, bedded sediments and jointed igneous rocks, and as permanent support in main roads underground or as a means of temporarily holding up the back of stopes.

Use of Concrete for Support

Concrete is becoming increasingly used instead of timber in such places as scraper drifts in block caving. In the Canadian Jeffrey mine concreting has been made easier by the introduction of aluminium shuttering which is made in sections that are bolted together. The sections are light enough to be readily handled by one man.

The placing of the wet concrete as a lining for scraper drifts and similar uses mechanically was solved at Nchanga by charging the mixture (all minus 2 in.) from the concrete mixer into a receiver and discharging it by compressed air into a specially designed steel pipeline with wide bends and quick couplings. A discharge distributor fitted at the end of the pipe prevents segregation and controls the discharge of air.

Progress Towards Continuous Loading

In horizontal development headings the operation of loading normally consumes more of the time in the cycle of work than any other task. Many advances have been made in recent years in drilling and blasting techniques ; but in loading, though cherry picker hoists, Californian Switches or other devices make the work of the miner easier, they do not cut out the problem of changing and spotting cars. It is interesting, therefore, to note a method of continuous loading with no interruption in the work of the loading machine. At Boliden, direct scraper loading into a full rake of cars sufficient to take the complete muck pile in a heading has been evolved by welding on both sides of each car a wide angle iron and arranging the couplings between

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British Belting & Asbestos Ltd. make this belting which, according to the 1950 REPORT OF H.M. INSPECTORS OF MINES (N.E. Division), *" is better than ordinary rubber belting both from the fire and the economic points of view." B.B.A. belting has the registered brand name " Scandura."*

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cars so that there are no gaps between the cars. A short ramp leads the scraper tool over the first car which then, passing over all the cars, loads them first and then tops them up. It means, of course, that the scraper operator has no pauses while cars are being positioned and can fill as fast as he can collect the broken rock. The cars must be of strictly uniform height and width and the track well laid.

Scraper loading is still, however, an intermittent process, the tool continually returning to the face for a fresh load. A German and American method overcomes this by using a continuous loader of the Joy collecting arm type feeding on to a sectional conveyor that is mounted on legs that stride the line of cars. The conveyor is made long enough to cover the whole rake of cars required to load the whole of the debris at the face. The last car is loaded first and drawn away by the traction unit in order to position the next one and so on until the whole train is loaded and can be hauled away.

It is claimed that in tunnels and straight haulage roads such methods sensibly speed up the work and enable more rounds to be drilled and blasted.

Trackless Haulage

Trackless haulage is increasingly adopted where the size of openings permits the replacement of small gauge track which would otherwise absorb labour in advancing to faces and maintenance. Two successful examples in this country are at Billingham and at the Santon iron ore mine at Scunthorpe. The reluctance to use diesel locomotives underground in North America seems to have been overcome as the introduction of diesel driven locomotives, shuttle cars and trucks in a number of cases has been noted. The last two help to lengthen the distance between loading point and dumping.

Developments in Block Caving and Waste Filling

In mining methods, where the orebody makes it possible, there is a trend towards reducing costs by adopting less selective systems, and block caving has been instituted in a number of areas with much attention being paid to improvements in technique and development reduction.

Sullivan has adopted a similar type of self-cementing fill to that used for some years at Noranda, where granulated slag and pyrite is used. At Sullivan float material from the sink and float plant and 4 per cent iron sulphide concentrate is used for filling stopes below the 3,900 ft. level. Ample ventilation is installed to reduce temperatures during the oxidizing period.

Surface Mining

Churn drills are being replaced by compressed air percussion drills and rotary drills. The latter with large carbide insert bits have successfully drilled holes up to 8 in. dia.

The most constant source of delay in opencast mines and quarries is secondary blasting, when equipment likely to be damaged by fly rock has to be removed to safety. This nuisance is overcome by the use of mobile, rubber tyred cranes with large drop balls of up to 2¼ tons weight for breaking boulders. It is reported that in some cases secondary blasting is practically eliminated. Such a method has been used by scrap merchants for many years to break up large cast steel and iron pieces.

The trend in surface loading and haulage is still towards large units. Diesel-driven rubber-tyred tractors with trailers carry a load of 60 tons and trucks (end-dumping or tipping) are up to 50 ton capacity. In some pits the tendency is to replace rail haulage to the crusher plant by the more flexible trucks and trailers. Shovels are in use up to 10 cu. yds. capacity but the more usual size is from 6 to 8 cu. yds.

RapieR W.1400 — the world's largest Walking Dragline.

The problem of stripping overburden 100 feet deep from iron ore beds in Northamptonshire has been solved by the RapieR W.1400 Walking Dragline designed and constructed to the order of Stewarts and Lloyds, Limited. The 20 cu.yd. bucket, excavating nearly 30 tons at a time is carried on a 282 feet long boom, the total weight of the machine being 1,600 tons.

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Huwood

The large trunk conveyor shown above illustrates both good theory and good practice. It is built up of open structure to facilitate inspection. The structure is raised to keep the return belt clear of the floor. It is fitted throughout with Huwood Oil-filled Idler Rollers, and all belt joints are vulcanized. The conveyor is approximately 1400 yards long, is driven by a 60 h.p. G.T.B. Drive Head, the belt being 42 inches in width.

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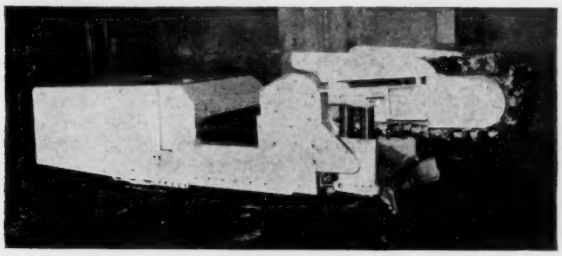
Coal Mining Practice

By W. DAVIS, Ph.D., B.Sc.

FROM an engineering standpoint the most difficult problem which remains to be solved in British coal-mines is the mechanization of long-wall faces, particularly for power loading and stowing. The most promising development of recent times has been the introduction of the flexible armoured conveyor which appears to be the key to power loading with many types of cutters as well as with ploughs. The conveyor is placed within a few inches of the face so that a large proportion of the coal



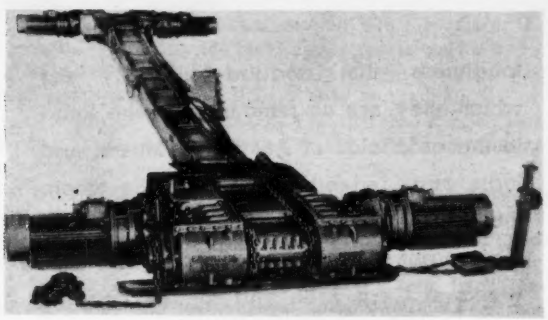
The Dosco Miner

brought down by the machine or plough falls directly into it. In a 7 ft. seam as much as 70 per cent of the coal may be self-loaded in this way and up to 50 per cent in a 4 ft. 6 in. seam. The remainder of the coal is lifted on to the conveyor by a trailing ramp or plough.

Progress with Coal Cutters and Ploughs

During 1953 the following new or relatively new machines were in use or on trial in the various N.C.B. Divisions :

Meco-Moore Cutter Loader. About 115 of these machines are now in regular use and last year they produced 7,500,000 tons of coal which constituted the bulk of the country's power loaded output. This is the only machine which may be said to have passed beyond the experimental stage, but on account of its size and weight its use is restricted to moderately thick seams under good natural conditions. The



The Lobbehobel Plough

latest innovation is the addition of a second cutting head which enables the machine to be turned round quickly so that the face can be traversed twice a day instead of once. A double shift can thus be worked on the face and although this does not necessarily increase the output per manshift it increases the load factor on the face machinery, which is an important advantage in view of the high capital cost of the equipment.

Gloster Getter. This machine is in the same category as the Meco-Moore cutter loader but it is designed to work in thinner seams. It is still in the experimental stage of development but it worked satisfactorily in very hard coal last year.

Mavor and Coulson Multi-Gib Cutter. This machine has been evolved from an ordinary coal cutter to extract thin seams more or less in the same way as a continuous miner and most of the coal is therefore reduced to small sizes. This is not objectionable when the coal is to be used for the manufacture of coke, hence the machine is likely to find its field of application in Durham and other places where thin seams of coking coal are available. It is fitted with two or more gibs one above the other with rotary pick breakers in between.

Anderton Disc Shearer. This machine also has been evolved from an ordinary coal cutter by replacing the gib

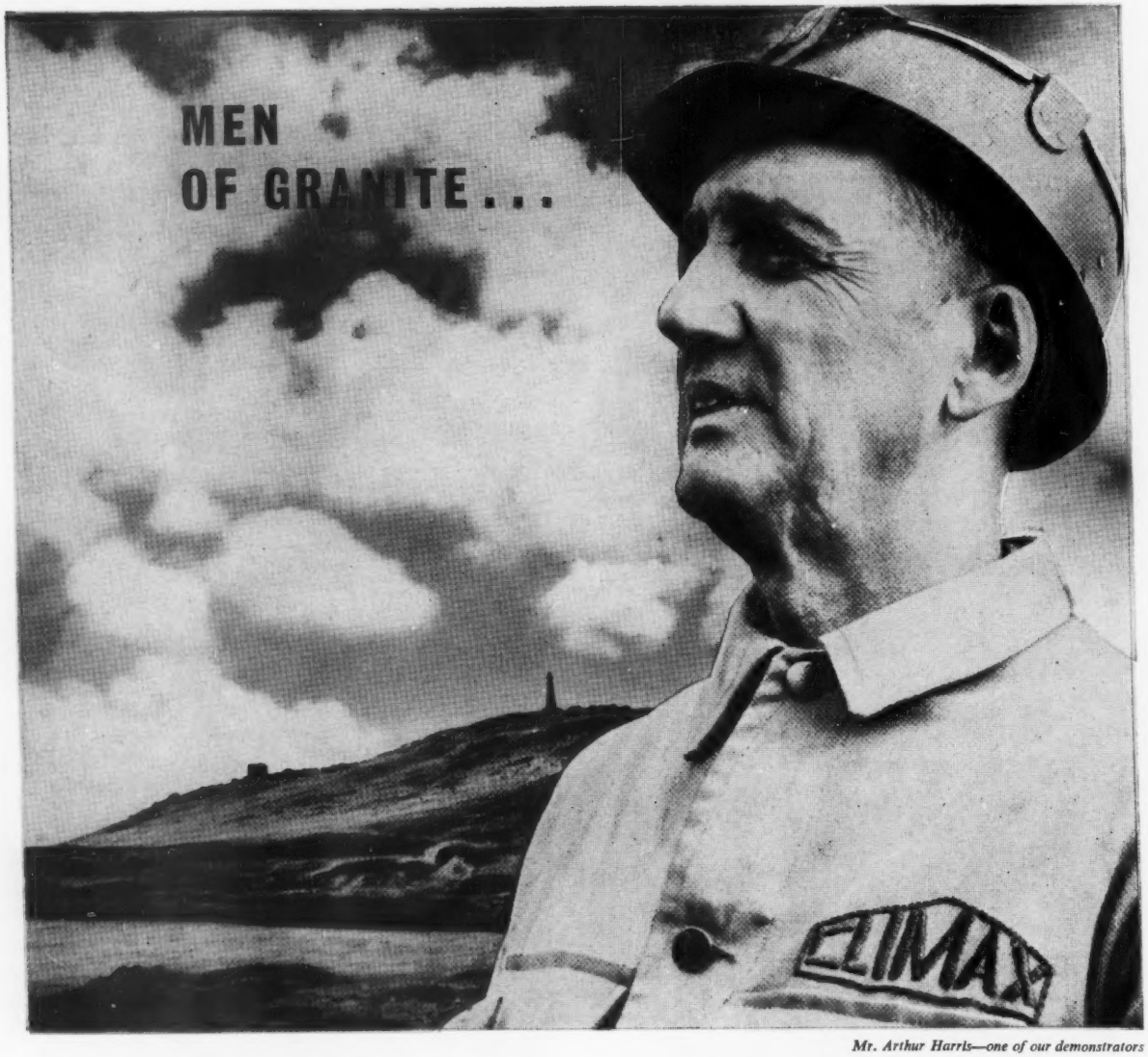
The Joy Miner

by cutting discs with their planes vertical and parallel to the face. The machine is mounted on an armoured conveyor and is fitted with a trailing plough or ramp to gather the broken coal on to the conveyor.

Joy Continuous Miner. This machine was designed for room and pillar work in the United States and its field of application in Great Britain is therefore restricted to coal headings and narrow faces.

Dosco Continuous Miner. This machine is produced by the Dominion Coal Company of Nova Scotia and is an adaptation of the Joy Continuous miner principle for long-wall work. One unit was brought over to this country last year for trials which will be carried out after the machine has been modified to comply with the electrical regulations.

Lobbehobel. This is the well-known German high speed plough which has given promising results in the softer seams in Great Britain and in the United States. The



Mr. Arthur Harris—one of our demonstrators

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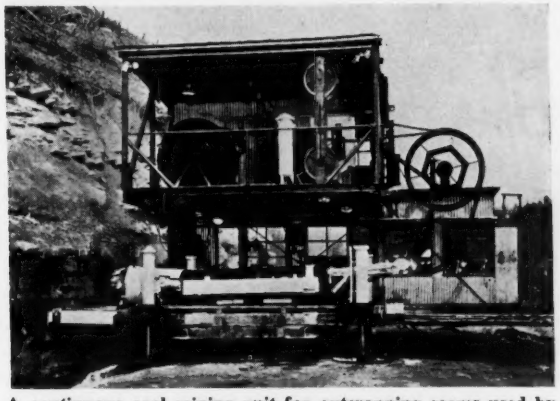
plough is hauled by a chain and the coal is lifted on to the conveyor by the trailing end of the plough. It is used in conjunction with an armoured conveyor which holds it up to its work on the face. Water infusion has been found to render some coals more amenable to ploughing and this may extend the field of application of this method of coal getting in Great Britain and elsewhere.

Schramhobel. This is another German plough which moves at a lower speed than the Lobbehobel and is fitted with a stepped knife. So far it has not proved very successful except in very soft coal.

Gusto Dutch Plough. This consists of several ploughshares attached at intervals to the same rope, and each plough cuts only a portion of the face by moving backwards and forwards over a distance of about 15 yds. This may prove useful on long-wall faces in disturbed ground since parts of the face could be worked by hand if necessary by removing one or more of the ploughs.

Huwood Slicer. This is a combined ploughing and cutting device mounted on the conveyor and hauled by a rope attached to a winch. The edge of the blade is toothed and



A continuous coal mining unit for outcropping seams used by the Carbide and Carbon Chemicals Co., U.S.A. (see page 89)

is given a reciprocating motion as it cuts into the coal to take off a slice about 1 ft. thick.

Scraper Box. Scraper boxes working on the principle of the slusher were in use many years ago in the north of England for loading coal, and this modern version, produced in Germany, is fitted with knives to cut into the coal as the box is dragged along the face. To overcome the resistance of British coals by this means very strong ropes must be used and winches up to 300 h.p. may be required.

Anderson Boyes Trepanner. This machine is fitted with a rotary cutter resembling that of the American Marietta heading machine in principle, but the arms carrying the cutters are shaped so that they scoop the broken coal to the conveyor which lies parallel to the axis of rotation of the head. The first machine had one cutting head only and had to be turned round on reaching the end of the face. This proved impracticable and machines with two heads facing in opposite directions are now being built.

The Auger. The type of auger used in America for extracting coal beyond the walls of opencast mines could have a limited application in Great Britain for the partial extraction of a seam or pillar, and a few experiments have been carried out with two units made in the United States. The problem of ventilating the cuts arises when this method of extraction is used underground and work is now held up until this problem is solved.

The Economics of Mechanization

From observations made last year under working conditions in the East Midlands Division the Mechanization Engineer in the No. 7 Area assessed the performance of some of these machines and compared them with the results obtained when loading is done by manual labour. The results of this investigation are summarized in the following table.

	Meco-Moore	*Samson Stripper*	*Lobbe-hobel*	*Curved jib cutter*	*Hand loading*
Capital cost ...	£14,300	£17,500	£21,500	£10.600	£6,300
Face advance...	6ft. 7in.	8ft.	10ft.	6ft. 7in.	4ft. 2in.
Output (tons)...	518	630	786	518	328
O.M.S. (at face)	7.5	7.5	10	6	5
Cost per ton—					
Wages at face	6s. 8.0d.	6s. 8.0d.	5s. 0d.	8s. 4.0d.	10s. 0d.
Machinery ...	1s. 1.9d.	1s. 2.6d.	0s.10.4d.	0s.11.2d.	0s.10.3d.
Power	0s. 1.3d.	0s. 1.1d.	0s. 2.0d.	0s. 1.2d.	0s. 0.8d.
Explosives ...	0s. 0.5d.	0s. 0.5d.	0s. 0.5d.	0s. 2.0d.	0s. 4.4d.
Total	7s.11.7d.	8s. 0.2d.	6s. 0.9d.	9s. 6.4d.	11s. 3.5d.

The calculations were based on the assumption that the machines worked double shifts on a single-unit face 175 yds. long in a 4 ft. 6 in. seam. The capital costs given in the table covered the initial outlay on all the machinery and equipment at the face including roof supports. The item for machinery in the costs per ton includes interest at 5 per cent per annum on the capital outlay, annual depreciation of 18.75 per cent on loading machines, and 12.5 per cent on conveyors and also appropriate maintenance charges for all equipment. This investigation led to the following general conclusions :

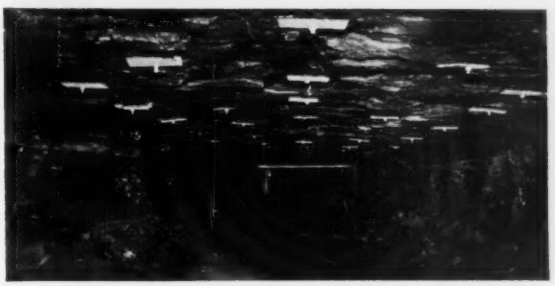
(a) Scraper chain conveyors at the face are far less costly to maintain than belt conveyors. Rubber and polyvinyl belts are expensive and may cost anything from 4d. to 6d. per ton of coal conveyed.

(b) Power loading machines must be operated on double shifts if capital charges are to be kept within reasonable limits.

(c) The cost of power for coal getting with machines is more than counterbalanced by the savings on explosives.

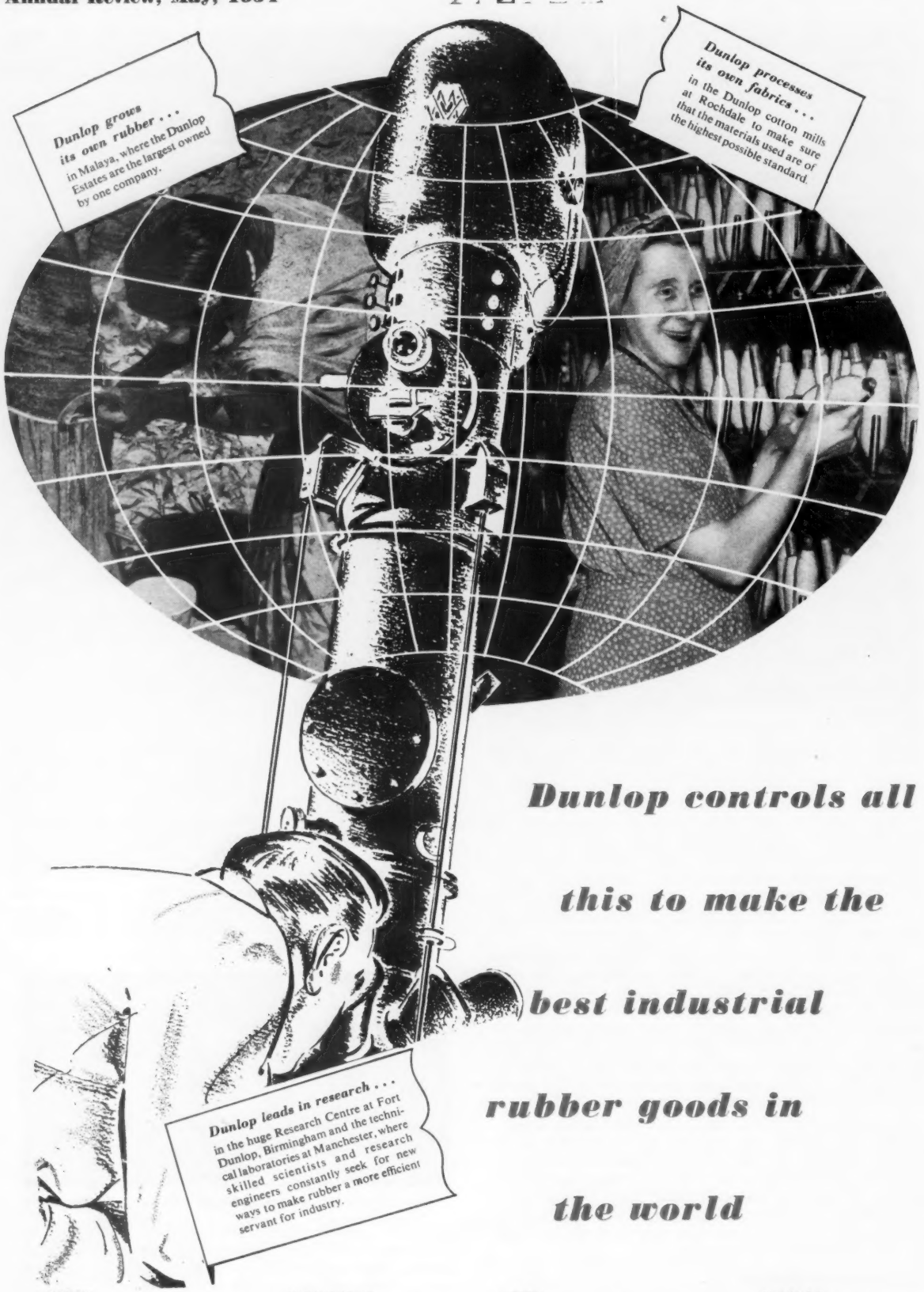
Roof Supports

Yielding props are now widely used on mechanized faces, particularly where the type of machine employed requires a prop-free front. By the end of 1953 over 500,000 of these props had been delivered to the pits and about half of them were of the hydraulic type designed to yield at 20 tons. Newer types designed to yield at 40 tons are to be used shortly in the East Midlands Division and experiments are being carried out with combinations of hydraulic props and bars formed into units which can be released and moved forward automatically under hydraulic pressure. Hydraulic chocks are also being produced to withstand working loads of 80 tons.



A roof-bolted roadway at Reedley Colliery, Yorkshire

It is not possible yet to say whether roof bolting is likely to become of real importance in Great Britain where it has hitherto been used only as an adjunct to ordinary supports on roadways and occasionally at the face when layers of roof tend to fall between the bars. Some experiments were also made last year with " floor " bolting to prevent heaving but it will take time to observe the results.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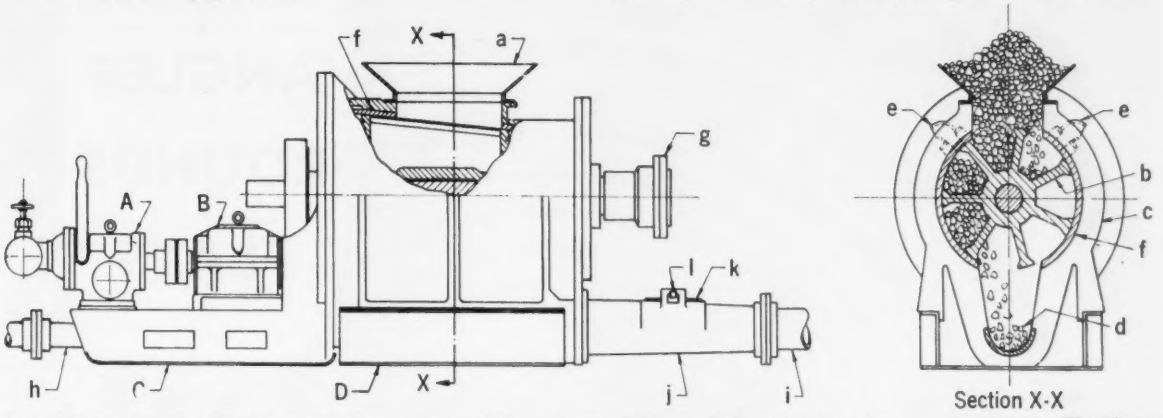
Stowing

Power stowing on long-wall faces is proving almost as difficult a problem to solve as the mechanical loading of coal and much more experimental work must be carried out on machines and the methods of using them. Pneumatic machines which deliver debris into the goafs from the gate roads require such large quantities of compressed air that the transmission of the air is in many cases a serious problem.

Some preliminary work was done last year on the development of smaller machines which can be taken into the face and it is intended to supply these with low pressure air from inbye turbo-compressors or blowers having three stages and arranged for air cooling. Each of the first three compressors ordered for this work will deliver 2,000 cu. ft. of free air per min. at 18 lb. per sq. in. gauge. Various types of dynamic or throwing machines are also undergoing trials but the slusher or scraper bucket has proved to be the most useful arrangement for stowing roadhead rippings.

Coal mining engineers might with advantage study more closely the methods used in metal mines for back filling in connection with this problem.



Assembly drawing of a Brieden pneumatic packing machine, tests on which, in a U.S. anthracite mine, were described in *The Mining Journal* of October 2, 1953.

Tunnelling

The adoption of the horizon system of mining in some parts of Great Britain will involve a considerable amount of tunnelling in hard rock for many years to come. Last year 600,000 manshifts were devoted to this work and the amount of labour required will increase rapidly as time goes on unless a greater degree of mechanization can be achieved.

Some preliminary experiments were carried out last year with one of the Marietta machines imported from the United States. This machine was originally designed for driving headings in coal but it is hoped that some of its basic principles may be applied in machines designed specifically for harder rocks. The new central engineering research establishment at Bretby, in Derbyshire, has been planned specially to deal with problems of this kind but it will take a long time to evolve a machine to do this work more rapidly than by drilling and blasting. This is a project that should be undertaken jointly by the coal and metal mining industries.

Underground Transport

Conveying is now firmly established as the most suitable form of transport at the face and on gate roads but opinions are divided on the relative merits of different systems of haulage on main roadways. A special committee has been set up by the National Coal Board to study the problem of roadway conveying and since practically every type of conveyor of British and foreign design is now on trial in one Division or another, it is expected that this committee will be able to issue a comprehensive report on the subject. As far as the East Midlands Division is concerned there appears to be no doubt about the superiority of trunk conveying as indicated by the following figures, which give the distances covered by various forms of transport in the Division at the end of 1953 : *face conveyors* 73 miles, *roadway conveyors* 432 miles, *wire ropes* 92 miles, and *locomotives* 6 miles.

Most of the locomotives used in all the Divisions at present are of the diesel type, but a battery locomotive of 90 h.p. was installed at one pit last year and it is believed that this type will come into more general use in the future because of its relatively low maintenance cost. The reason why it has not been more widely used in the past is that it was not built in sufficiently powerful units in this country for main haulage.

An electro-gyro locomotive is being tried out on the surface at one colliery to see if it can be of any use for mining. It is propelled by the kinetic energy stored in two flywheels of 5 ft. 3 in. diameter running at a maximum speed of 3,000 r.p.m. The wheels are set in motion by a squirrel cage induction motor supplied with current from any convenient point on the power supply system. This motor is then used as a generator to supply current to the traction motors at the expense of the kinetic energy of the flywheels and for this purpose it is excited from a battery to enable it to act as a variable frequency alternator.

Winding

The aim in Great Britain and on the Continent is to reduce the number of winding shafts to a minimum, hence most future coal handling and hoisting arrangements will be designed for intensive winding from all depths in order to make the fullest possible use of shaft space. It may be inferred, therefore, that skips will be used to an increasing extent and will be excluded only in cases where there are serious objections to them on account of the friability of the coal or because the outputs from different seams have to be segregated. There are 11 skip winders in operation in Great Britain at present and more are to be installed at some of the new mines which are now being sunk and at some of the reconstructed mines.

The National Coal Board are interested in the possibilities of automatic winding not only as a means of reducing the amount of labour involved in bringing coal to the surface but also as a means of increasing the rate of winding. The forms of automatic control used at present are :

(a) Full automatic operation without human intervention where the winder is started off by the closing of a switch by the bottom skip when it is fully loaded.

(b) Push-button control whereby the onsetter or banksman starts the winder which then completes the wind without further intervention.

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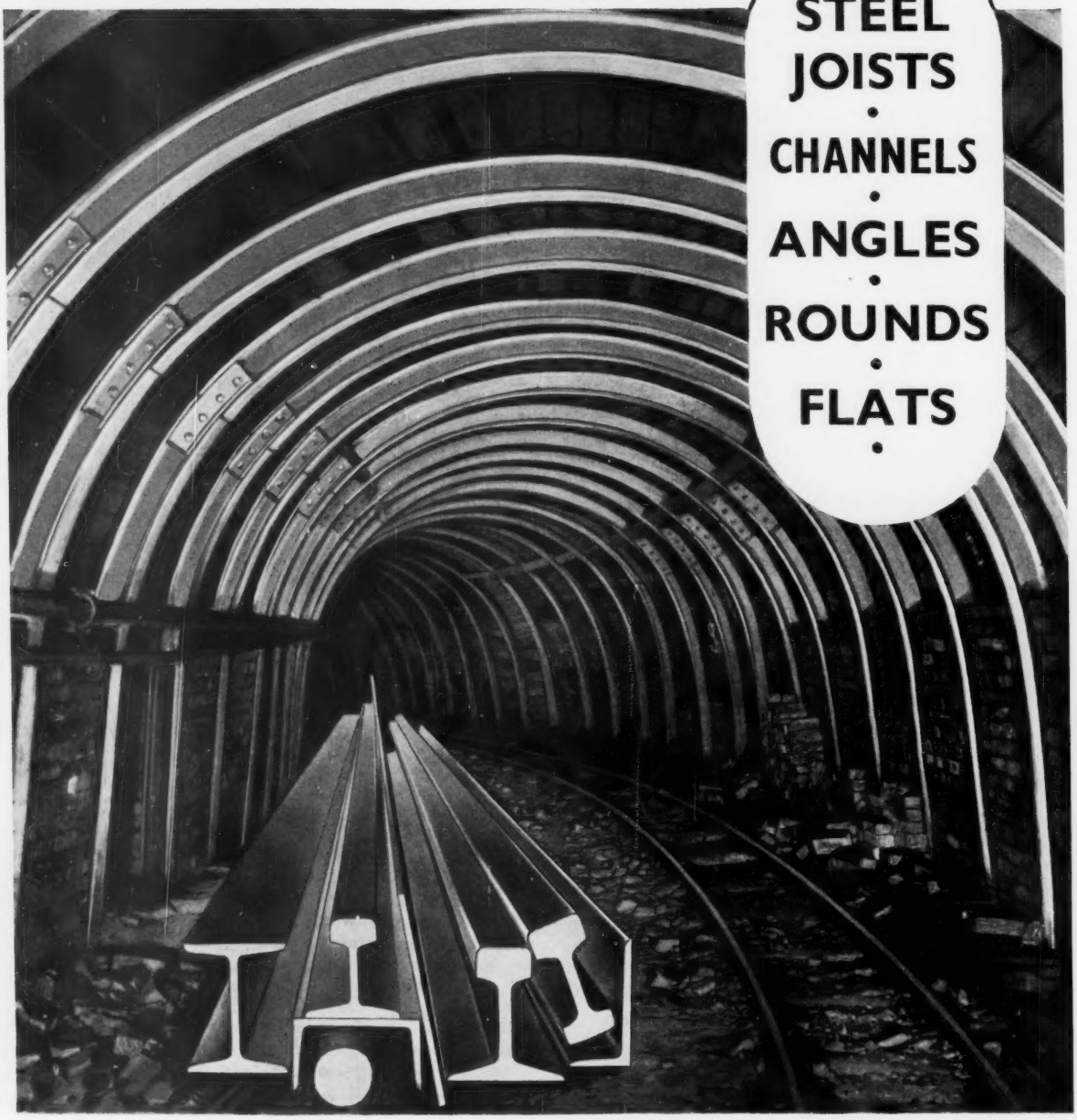

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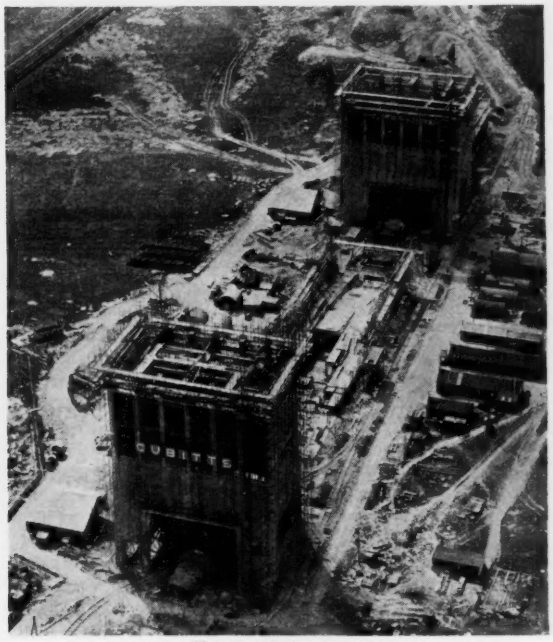
(c) Cyclic control where the engine driver merely starts the winder and applies the mechanical brake at the end of the wind. The latter form of control is compulsory at present when men are being wound.

Several automatic winders have been built recently in Great Britain, mainly of the D.C. Ward-Leonard type for use in South Africa. From the technical standpoint the main problem in the design of such winders is to render the speed at any given point in the winding cycle independent of the load in the skip or on the cage. It is easier to do this with the Ward-Leonard D.C. system than with an A.C. winder but, in view of the lower cost of the latter, the emphasis at the present time is on the development of devices to improve the characteristics of the induction motor.

The use of direct current for dynamic braking with A.C. winders has now become standard practice in Great Britain and various schemes have been devised recently to keep the speed of the motor within prescribed limits automatically throughout the wind irrespective of the load. One such arrangement is known as the closed-loop servo system, in which a combination of mechanical and electrical devices adjust the rotor current and the excitation to the extent required to bring the speed of the motor back to its proper value should it depart from the normal speed curve.

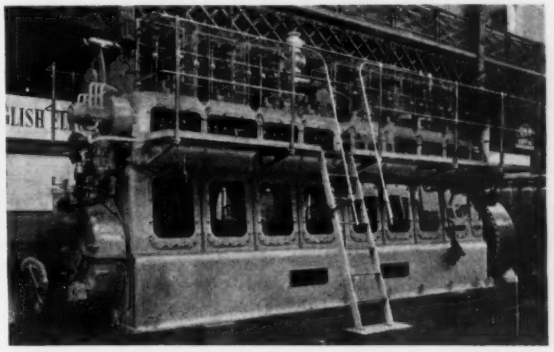
Some of the new deep mines are to have tower mounted Koepe winders and consideration is being given to the use of the multi-rope system with these winders. This consists of two or more ropes in parallel instead of the usual single rope. Its advantages are that the individual ropes are lighter, and therefore easier to handle, than a single rope and it provides a better grip on the pulley as well as a higher factor of safety for a given rope stress. A single rope to wind a very heavy load from a considerable depth becomes unduly large and inflexible and it was this consideration which first led to the decision to use the multi-rope system in Germany after the war, but it has since become popular there and in Sweden on its general merits.



Koepe winder towers

Methane Drainage

Methane is now being drained from a number of mines and a good deal of attention was given last year to the most effective and economical ways of using it. The National Coal Board and the Ministry of Fuel and Power are collaborating in the installation of a 2,000 kW. gas turbine at one colliery not only so as to use the methane drained from the workings but also that contained in the air



The English Electric Type 8RLD industrial fuel engine motivated by methane gas

ascending the upcast shaft, which is to be directed into the compressor of the turbine instead of atmospheric air.

Some Problems Facing the American Coal Industry

It is estimated that $5,000,000 was spent in the United States last year on new coal mining equipment. Although American methods of working have for many years been the most productive in the world, the present situation in the coal industry calls for still greater efficiency and increasing attention is therefore being given to the new techniques of continuous mining. During the last few months 58 machines of the continuous miner type in 22 different mines have yielded an average output of 28.2 tons per manshift at the face and in some cases as much as 50 tons. Such large outputs from single faces of small width are putting a severe strain on the existing transport systems and this aspect of the problem received a good deal of attention during 1953. The obvious solution would be to use high speed belt conveyors from the face to the surface and it is predicted that most new mines in the future will be planned from the outset for continuous mining on these lines.

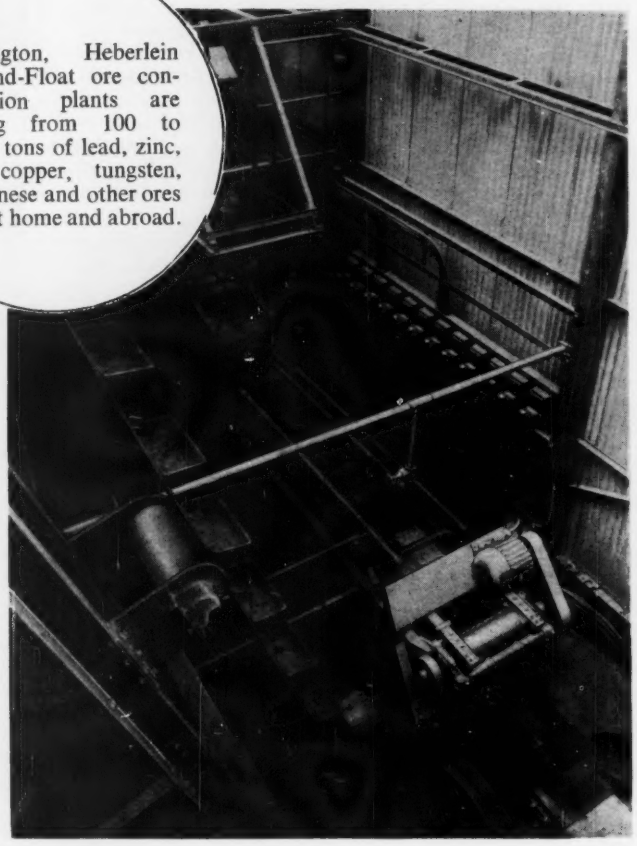
The rate of advance of a continuous miner operating on a narrow face may be anything up to 100 ft. a day and the problem of keeping the room or roadway conveyor up with the machine is solved by using a mobile bridging conveyor unit to follow the machine and deliver the coal to the roadway conveyor well to the rear of the face. In this way the front end of the roadway conveyor, which is usually of the scraper chain type, is accessible for additional lengths to be put on as required. A high rate of advance is conducive to greater safety at the face but it renders the setting of roadway supports more difficult. Roof bolting is used whenever possible and in some cases the drilling rig is mounted on the continuous miner itself so that the holes can be drilled when the machine is standing in one position whilst the cutting head is traversing the face. At the end of 1953 there were 300 continuous miners in use compared with 175 at the end of 1952.

Over 25 per cent of all the coal produced in the United States last year came from strip mines. The introduction of the auger for the extraction of coal beyond the economical limits of stripping has extended the useful life of many of these mines; improved dragline excavators also make it possible to strip further back and 170 ft. of cover is now being removed from a thick anthracite seam in Pennsylvania. An experiment was carried out last year with a continuous miner instead of an auger to dig under cover. The machine, which was operated by remote control, penetrated about twice as far as the auger and extracted 70 per cent of the coal up to 350 ft. from the high wall.

One way and another

Huntington, Heberlein design and build a comprehensive range of plants for the separation and treatment of a wide variety of minerals.

Huntington, Heberlein Sink-and-Float ore concentration plants are treating from 100 to 10,000 tons of lead, zinc, iron, copper, tungsten, manganese and other ores daily at home and abroad.



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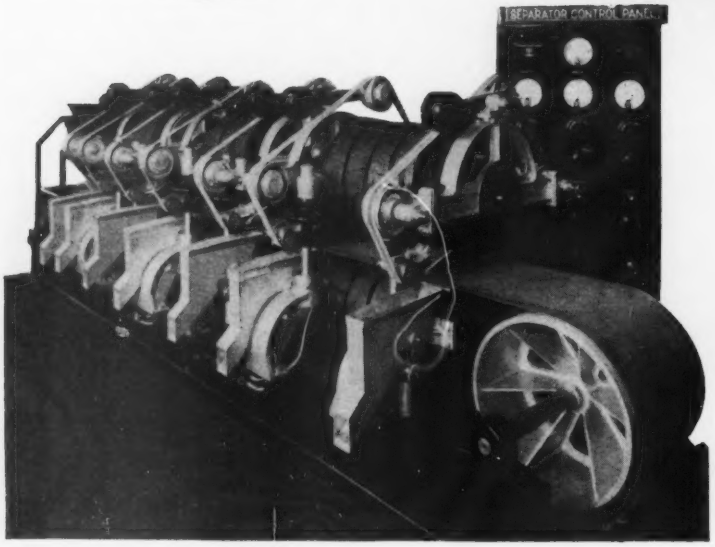

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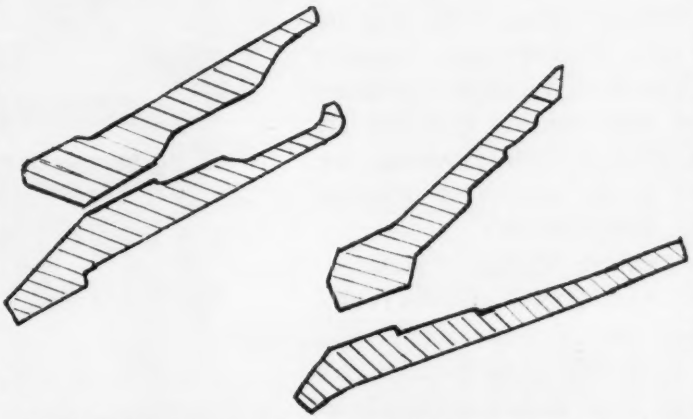
HH12

Progress in Mineral Dressing

By F. B. MICHELL, B.Sc., A.C.S.M., M.I.M.M.

PROBABLY some of the most interesting developments during the year relate to new hydrometallurgical processes, which strictly speaking do not come within the scope of Mineral Dressing. Nevertheless, these processes are being fitted into flow-sheets and, in due course, it seems likely that they will be used in conjunction with conventional dressing procedures.

Another trend is that the mineral dresser is being called upon increasingly to concentrate minerals which heretofore have received little, if any, serious attention. To cite a few examples only, various new metals or ones formerly considered rarities are coming into prominence, such as columbium, tantalum, titanium and indium, and the dressing of complex mixtures of minerals containing such metals is becoming of economic importance. Large deposits of columbite-bearing granite have been located in Nigeria, in which the columbite amounts to only a few lb. per cu. yd. and at least one pilot plant is now in operation. Elsewhere the production of ilmenite and rutile is assuming a big tonnage, monazite is being recovered from material formerly discarded and the problem of treating pyrochlore bearing ore is receiving attention, not to mention the large increase in uranium production such as on the Rand where gold may easily become a by-product in some mines to the more important uranium.



Zoned jaw faces for cone crushers. The drawing on the left shows modifications for tertiary crushing with three jaws, while that on the right is for coarser crushing with maximum liner thickness where the wear is greatest

Following the success of the symposium organized by the Institution of Mining and Metallurgy in London in 1952 a similar meeting was held towards the end of September in Paris, and it is hoped that other meetings of European engineers will be held every other year. It has been suggested that in 1955 the meeting might be in Germany. At the Paris symposium, 28 papers were presented and the sessions divided into seven sections, the first two dealing with the theory and mathematical aspect as well as the economics of the subject, one section dealing with laboratory work and mill control, one dealing with iron ores, one with gravity concentration, one with industrial flotation and one on flotation research. Interesting rapid methods for the determination of lead by the polarigraph were also described and the identification of mineral particles by surface coloration discussed.

Crushing

No revolutionary developments have appeared in crushing and grinding. The coarse crushing rod mill continues to find favour, being run at a high speed, and in addition to a number in the United States and Canada, New Broken Hill Consolidated have installed the first large primary rod mill in Australia.

The largest gyratory crusher to be built in Europe was exhibited at the Hanover Technical Fair and has been designed to handle 1,000 tons per hr. The Kue Ken crusher is now being built in this country by Sir W. G. Armstrong Whitworth and Co., of Gateshead-on-Tyne.

From Germany there are reports of a new type of mill which is now also being tried out in the United States. Designed by Ludwig Pallmann, of Zweibrüken, it is claimed to grind and pulverize a wide range of materials more efficiently, faster and at a lower cost than has been possible heretofore.

Employing a principle observed by Pallmann in nature, the Turbo-mill, as it is termed, duplicates the ricochet action of the wind pulverizing rock and sand. Miniature wind storms of 360 ft. per sec. are created inside the mill.

The Nordberg Co. have carried out a very extensive investigation concerning the contour of jaw faces. As a result they have arrived at the conclusion that a greater maximum reduction ratio can be effected if the crusher cavity is designed for a series of crushing zones (see illustration), each properly proportioned volumetrically. It is possible to provide a 7½in. receiving opening on a 3 ft. cone crusher at a 1 in. setting instead of 4½ in. opening by using this new design and also the new gape is equal to that of a 4 ft. crusher. Similarly a 4½ ft. machine can be supplied with a 12 in. opening which is equivalent to that usually found in a 5½ ft. crusher. The idea is sound as by this means it is possible to keep the angle of nip smaller in each stage, whereas it would be excessive if one sweeping cavity were used. In many cases investigated the modified liners have proved excellent, but there have been a few failures which certainly gives weight to the argument that a liner should be " tailored " to suit the particular conditions.

In screening practice, the Hanco electric screen heating equipment to prevent blinding has been improved by employing a new type of glass insulation throughout the heating system which is reputed to improve operating efficiency and provide longer heater life.

Grinding

The tendency shown during the last few years to install big diameter mills is still evident and six units 12½ ft. by 13 ft. (inside liner) are being installed at White Pine. One mill with the liners will weigh 300 tons and the plant is expected to be in operation by the end of the coming year.

A novel feature in rod mill liner design was suggested by MacDermid, of Snow Lake, when he tried using the lift in only the two liners adjacent to the ends of the mill. This worked well, simplified liner construction and cut down the dead weight.

There appears to be an increase in the use of spout feeders instead of the scoop; this trend is interesting as many years ago almost all the large tube mills on the Rand used the spout feed.

Big circulating loads carrying large amounts of finished material are going out of favour and hydrocyclones are replacing bowl classifiers in many instances.

A theory has been advanced that for best grinding the

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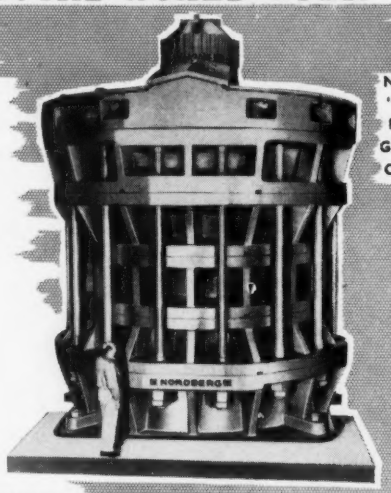
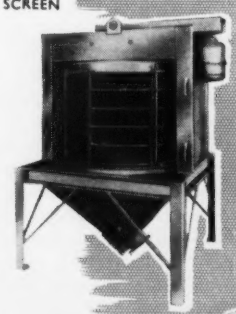
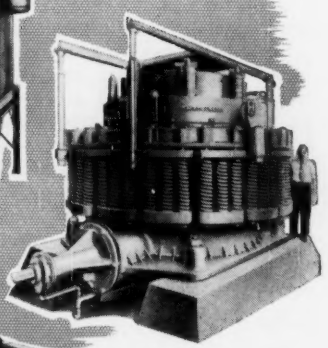


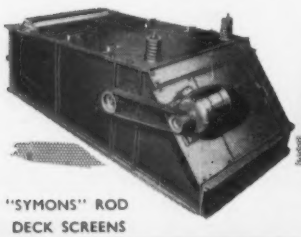
NORDBERG "SYMONS" PRIMARY GYRATORY CRUSHER

"SYMONS" 'V' SCREEN

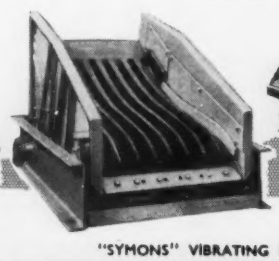




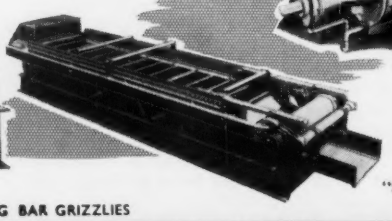
"SYMONS" CONE CRUSHER



"SYMONS" ROD DECK SCREENS



"SYMONS" VIBRATING BAR GRIZZLIES



"SYMONS" HORIZONTAL 'F' TYPE SCREEN

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surface of the grinding media, rather than being smooth, should be rough and pitted to retain the particles being ground. It is interesting to speculate on the possible effect of the use of ore " pebbles " as a grinding media, as such rock is usually hetrogeneous and may become pitted where the softer constituents wear more readily.

Pegson, of Coalville, are now making the Marcy type of rod mills in the United Kingdom by arrangement with the Mine and Smelter Supply Co., of Denver. Included in their range is a central periphery discharge mill which was mentioned in the *Review* for 1951. The central discharge is claimed to be particularly useful for grinding friable material.

Allis-Chalmers have announced a spiral liner to assist effective ball segregation and the use of this liner is said to produce a lower level at the fed end and a higher pulp level at the discharge end, whilst large balls do not overgrind the smaller particles as the former are continually moved back to the feed end.

Milling Research at Copperhill

Probably the most interesting development in milling is the further work carried out at Copperhill by the Tennessee Copper Co. with the huge Hardinge Tricone mill. The ball load was reduced from 55 to 35 tons and as a result, the tonnage was increased from 2,130 to 2,250 tons, although the power requirement dropped from 490 to 370 h.p. Briefly, the result of lowering the volume occupied by the balls from 45 per cent to 29 per cent was not only to lower the power consumption, but also to reduce wear which dropped from 1.02 to .84 lb. per ton.

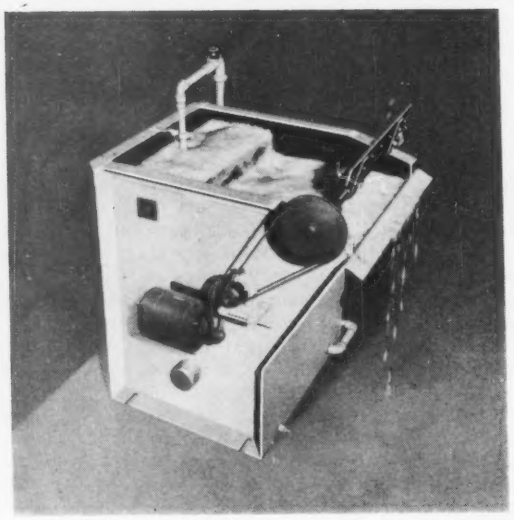
On the other hand, the amount of -200 mesh produced was lowered from 40 per cent to 35 per cent. This means that although there was a decrease in the power consumption of the mill, the ground product is considerably coarser, so that in terms of " new surface " or any other means of assessing the reduction in the mill, there is little, if any, reduction in power. The important point, however, is that in spite of the coarser grind, the tailing loss was reduced in the flotation plant whilst a lower reagent consumption was possible.

It would appear that the large " classifying area " or zone where there is a great deal of pulp but few balls, which has been made available by reducing the ball volume, has much to do with grinding control. Furthermore, it seems likely that in grinding a heavy sulphide ore, where it is desirable to grind the sulphide minerals finer than the gangue, there is distinct merit in running a mill with a smaller ball load so that a degree of selective grinding can take place. This is a very different problem to a case where classification is influenced more strongly by the particle size or where there is little or no differential in the hardness of the valuable and the valueless minerals. In consequence it would appear that each problem is likely to yield its own optimum conditions.

At the London plant of the Consolidated Mining and Smelting Co. at Kimberley, B.C., reduction in ball load to 47 per cent volume showed an advantage, but there was no improvement with further reduction in the volume occupied by the media. This is not the first time operators have found it advantageous to run a mill contrary to the generally accepted idea of 50 to 55 per cent ball load and a high pulp density. The result may not be as efficient grinding in some instances, in terms of a given product size, but this is not the sole consideration and may be outweighed by better recovery in subsequent treatment.

Other investigations at the Tennessee Copper Co. involved replacing a ball load with pebbles. The tests were done on a 5 ft. by 10 ft. ball mill, normally using 1 in. steel balls and employed for grinding marble which is produced to neutralize the acid in streams. The ball load was replaced by a load of -3 in. $+1\frac{1}{2}$ in. marble. Indications are that the results are attractive for this work.

K. & B. Pneumatic Flotation Machines



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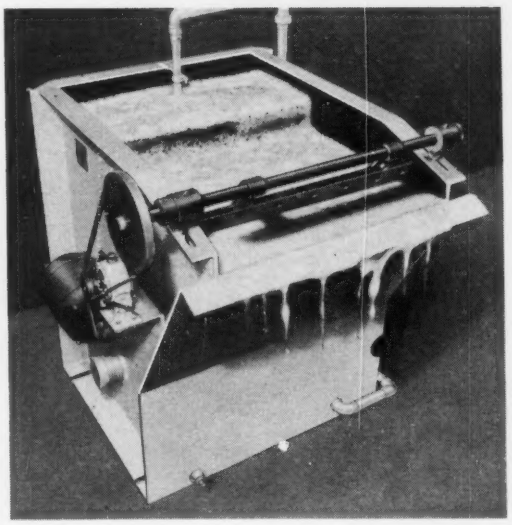

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Fine grained granite has been successfully used to replace balls at Nundydroog mine for fine grinding where 3½ in. pieces are now used in the mills, whilst at both Lake Shore and Wright Hargreaves local ore " pebbles " have now been used for three years, establishing firm operating costs and data. It is also understood that on the iron range of the United States some 400 tons per hr. of haematite is being ground in a 10 ft. by 66 in. conical mill using 4 in. ore as the media, and that the Neptune mine in Nicaragua is proceeding with an installation after successful pilot tests.

Speaking generally, the American Mining Congress arrived at the conclusion that a rod mill is more efficient when grinding by impact and therefore running at a high speed amounting to 80 per cent or more of critical, whilst the ball mill (or pebble mill) is best when run at a slower speed, down to 55 per cent of critical in some cases. It has also been suggested that the capacity of a mill varies as D^3 for coarse grinding and as $D^{2\cdot6}$ for slow speed fine grinding.

Grinding Theory

After the spate of papers on the theory of comminution in the past few years and Bond's new theory last year, we have heard little this year other than the work carried out by Ackermann on Tarkwaian and Witwatersrand quartzites using drop weight tests, impact and pneumatic pulverizers. As a result of these tests the author suggests that the energy absorbed consists of (a) energy of fracture following Rittinger's law, and (b) energy of preparation or the energy used in overcoming the elasticity of the rock, i.e. following Kick's Hypothesis.

Ackermann also suggests that for sizes normally encountered in industrial grinding plants this energy is probably far greater than the actual energy of fracture. Various figures indicating the power used are given and as a result of the investigation he considers that the amount of wasted energy in all comminution is very great, varying from a minimum of 65 to 90 per cent in impact machines to as much as 99.8 per cent or even 99.9 per cent in tube mills.

Djingheuzian has presented a paper on " The science of grinding " to the Canadian Institution of Mining and Metallurgy which is a thorough and up-to-date review of recent grinding theories.

Classification

During the past year this field has been taken up almost entirely with development of the hydrocyclone and its wider use.

On the Rand and in West Africa, cyclones are now being employed either to replace bowl classifiers or to assist them in grinding circuits. Owing to the increased effect of the specific gravity of particles on the separation it has been found that the cyclone tends to produce results very like those obtained in hindered settling classification. Under such conditions there is a greater release of gold and consequently subsequent cyanidation has shown improvement in test work carried out in West Africa.

On Rand Leases (Vogelstruisfontein) Gold Mining Co. a 14 in. cyclone is being employed in the primary circuit and a 24 in. unit as the final classifier. The merits of the liquid-solid cyclone compared with the conventional classifier are (1) the small unit required due to the much lower retention time which results in an enormous saving in capital (£325 compared with about £4,000 for a bowl classifier) (2) lower power requirements and (3) lower maintenance cost. A relatively low feed pressure of 5 p.s.i. is employed for normal classification when replacing a bowl classifier, so that the wear as well as power used is much lower than in a cyclone used for desliming duty when the size of separation is much finer.

The conclusions arrived at from the tests on Rand Leases are as follows :

(1) at a constant feed pressure, the larger the diameter

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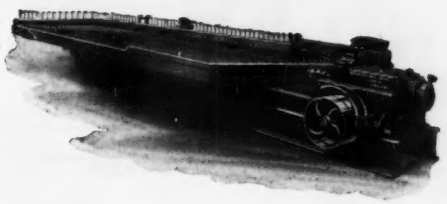

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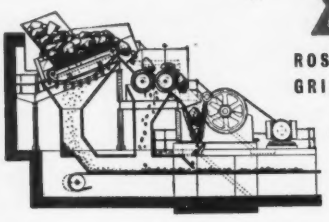
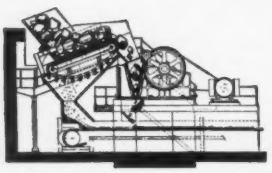


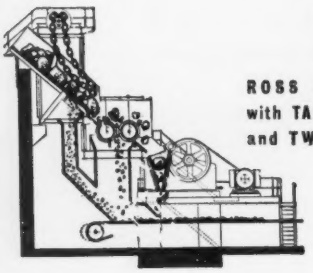
TYPE DB

ROSS DROP-BAR GRIZZLY FEEDER



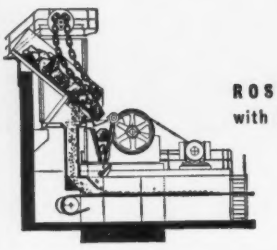
TYPE F.2R

ROSS CHAIN FEEDER with TAPER-BAR GRIZZLY and TWO-ROLL SCREEN



TYPE F

ROSS CHAIN FEEDER with ADJUSTABLE-APERTURE TAPER-BAR GRIZZLY



If the material is clean or fairly clean, any of the four plants may be used.

★ If the material is sticky, TYPE D B. 2 R only should be used.

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of the vortex finder the greater the tonnage reporting to the overflow and coarser the overflow grading ;

(2) at constant feed pressure, the larger the diameter of the underflow orifice (the vortex finder diameter being constant) the finer the overflow product consequent upon a larger underflow tonnage product ;

(3) the smaller the underflow nozzle diameter the higher the density of the underflow product ;

(4) the lower the pulp density of the feed the greater the efficiency ;

(5) dilution of the feed has little effect on the water in the underflow but affects the overflow considerably ;

(6) the spray type underflow is more efficient than the "rope" type although the latter contains less moisture ;

(7) the underflow discharge should be unrestricted to reduce back-pressure and to allow the air core to form. Consequently no tail pipe should be provided.

The behaviour of cyclones has also been discussed by Fitch and Johnson, of the Dorr Co., in a paper describing the mesh of separation, size of feed inlet and vortex finder, sharpness of classification and operating requirements. Erickson, of M. A. Hanna Co., has shown that under some conditions the cyclone also acts as a differential grinder.

A different cyclone design to the customary conical chamber has just been marketed by Equipment Engineers Inc., of San Francisco, which employs cylindrical instead of conical separating chambers and has two stages built in the unit. The makers point out that the presence of tramp oversize in the undersize is due in part to the air core and partly to short-circuiting from the inlet to the vortex finder, and that by creating a special shape from the edge of the vortex finder to the inside of the inlet the short-circuiting can be reduced.

It is well known that the wear is largely at the bottom of the cone in the normal hydrocyclone due to the greatly increased velocity and increased centrifugal force which presses the particles against the wall and the use of the cylindrical section is said to reduce the wear as well as wasted energy. The makers have also studied the effect of removing residual slime in the underflow by introducing clear water and the results quoted are certainly good. In general design this classifier appears to be very similar to one used for some years in Europe, particularly for coal cleaning, and was mentioned by the writer in "Recent Trends in Gravity Concentration" at the I.M.M. symposium in September, 1952. (Details of the design of this type employed for coal cleaning may be found in "Etude de quelques appareils de séparation centrifuge," by P. Belugou and Ait. Ouyahia, *Review Industr. Min., Paris,* No. 56, 31. pp. 512-520.)

Another modification made in the United States is a centrifugal force gravitational classifier, the action of which has been studied by R. C. Emmett and D. A. Dahlstrom, who point out that one of its merits is the low power requirements. It is reported to be possible to obtain both the mesh of separation and an equilibrium particle size well below that expected for conventional gravity classifiers on the basis of overflow capacity per sq. ft. of pool area. The classifier is also said to be immune from feed rate fluctuations and a single central overflow is desirable with a streamlined outlet to eliminate as much turbulence as possible. The pulp level can be held at less than 3 ft. above the feed pipe so that energy requirements are very small indeed, whilst overflow rates are said to be 78 per cent higher than the average for ordinary gravity classifiers and no choking of the spigot was noticed. It would appear that evidence points to a higher classification efficiency than is usually found in a normal hydraulic classifier and abrasion is not likely to be a serious factor as is the case with many conventional cyclone installations.

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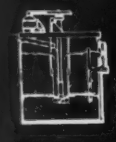
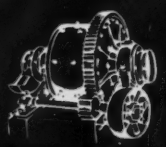
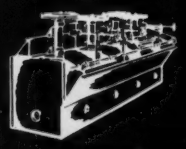
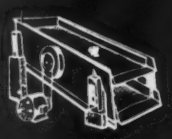

AGITATORS CONDITIONERS


STEEL-HEAD BALL-ROD MILLS


"SUB-A" FLOTATION MACHINES

VERTICAL SAND PUMPS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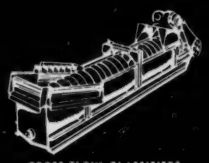
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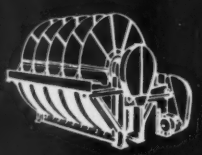
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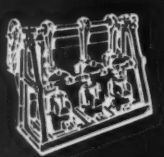
SELECTIVE MINERAL JIGS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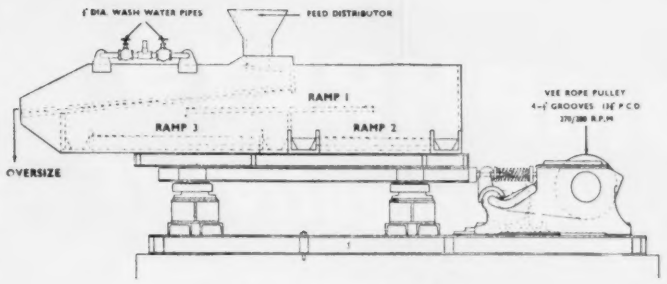
Illustrated here is quite another type of classifier by Holman Bros. Ltd., of Camborne, which relies on the differential in momentum of varying size particles when subjected to the conveying action of a vibrating deck and a flow of water. The unit is driven by means of a 2 h.p. motor employing the standard Holman vibrator as a head-motion. The feed enters by means of a distributor on to a ramp where initial classification takes place, the coarser material being conveyed forwards whilst the finer sizes flow in the opposite direction. Both products are re-treated in much the same manner so that four products are made. Provision is also made for screening ahead of the first classifying ramp. One unit is said to handle 2¼ to 2½ tons of $-\frac{1}{16}$ in. china clay rock per hr. and the classification is good, particularly in the coarser sizes. The whole apparatus is comparatively small, having an overall length of 7 ft. 4 in. and being only 2 ft. wide.



Holman vibratory classifier

Dense Media Separation

Dense media plants have naturally been on the increase, particularly for coal cleaning and in the dressing of iron ores. Probably the greatest expansion has been in the iron fields where in plants treating one size of feed the drum type of separator is preferred by most operators, but where two sizes are handled the Akin spiral form of separatory vessel is preferred for the finer material, retaining the drum machine for the coarser size. It is interesting to note that only one open top cone remains in operation in the Lake Superior district.

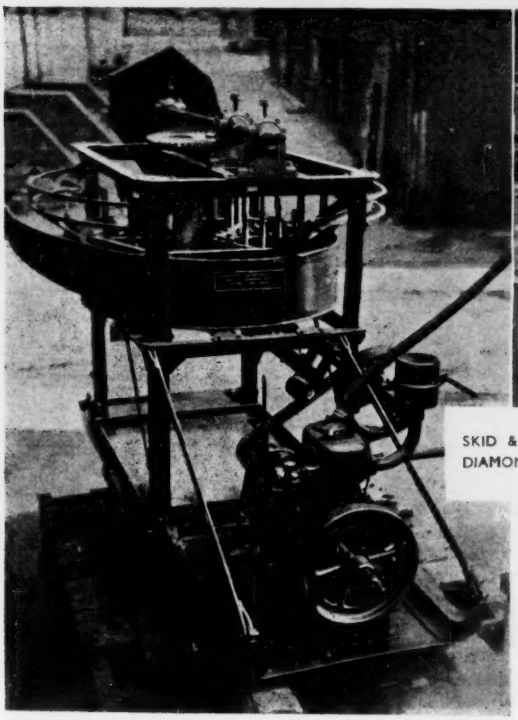
For the treatment of $-\frac{1}{4}$ in. $+80$ mesh material the dense media cyclone is now being employed. Such cyclones are usually 12 in. to 15 in. in diameter and treat a washed sand using a magnetite medium. The actual cyclone operation is said to be cheap but the equipment necessary for feed preparation and for the recovery of magnetite from both float and sink products is somewhat expensive.

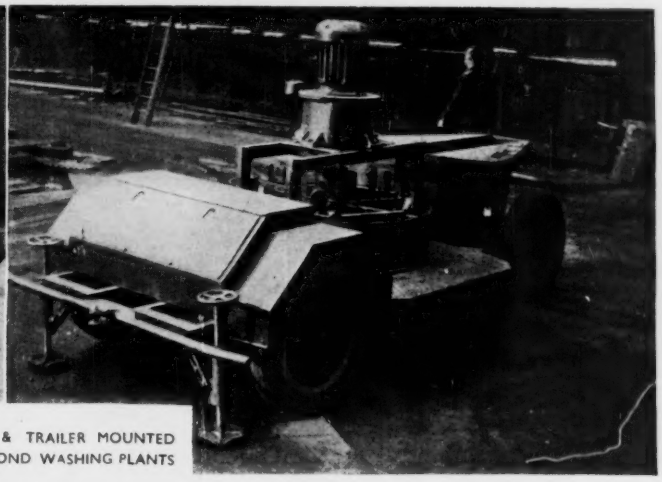
The Nelson-Davies rights are now handled by Neldco in the U.K., the process being simplified by omitting the magnetizing block and utilizing a specially designed separator for medium cleaning.

Gravity Concentration

In this field there have been few developments. A new double stroke jig has been developed by the Charleston Mining Co. for iron ore which has a high-speed short pulsation, superimposed upon the conventional stroke. The jig operation is characterized by the recirculation of a considerable middling so that any one jig is not expected to make both a concentrate and a tailing. These machines under such conditions are reported to give better results than have been achieved by normal jigging in the district.

R. O. Stokes and Co. Ltd. have recently announced their " buddle jig " for the beneficiation of large tonnages of low-grade ore. The design is similar to that used at West Rand Consolidated Mines Ltd. for over 20 years and employs a





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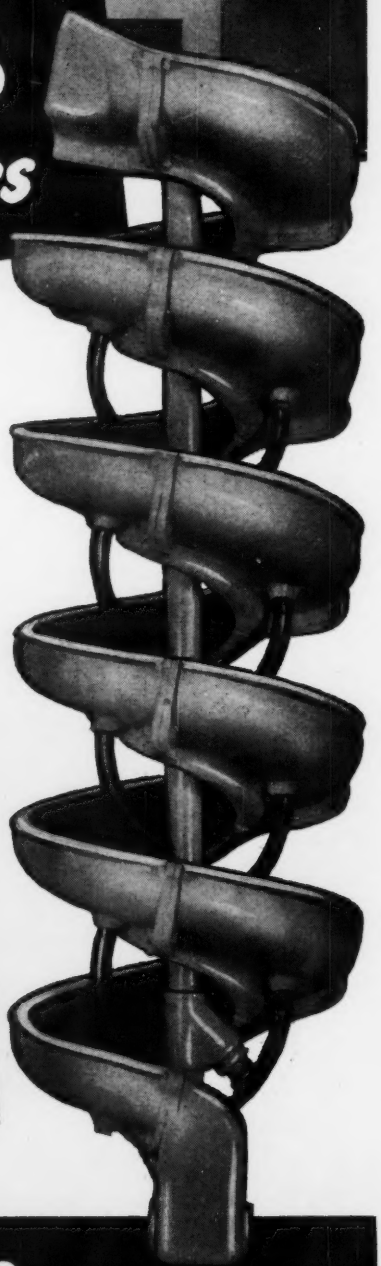

Low-Cost Concentration

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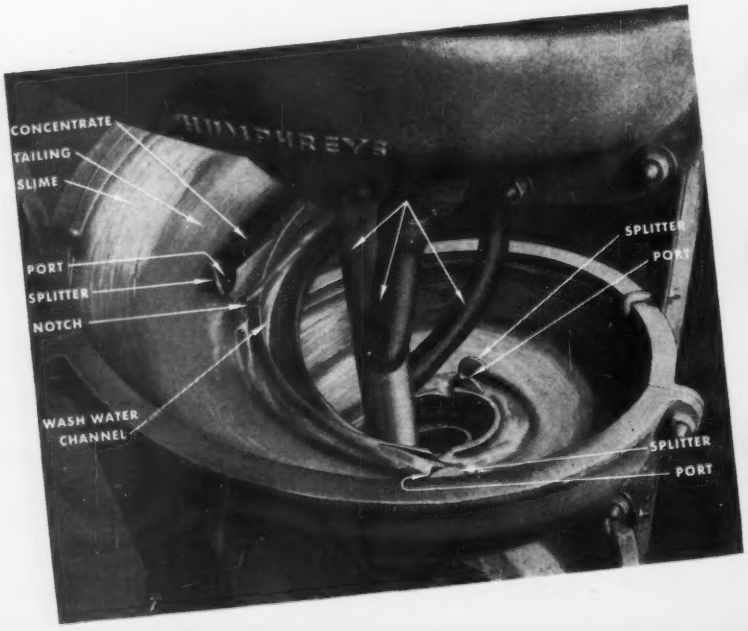

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moving sieve which is sealed to the hutch by means of a rubber diaphragm running at a comparatively high speed.

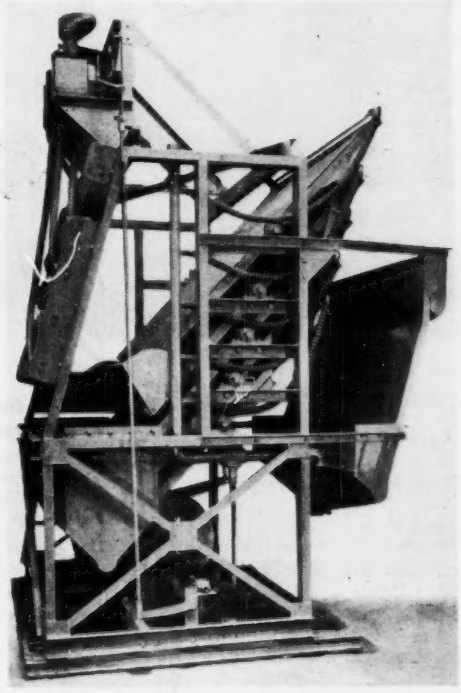
It is reported that over 4,500 spirals are now operating in various parts of the world treating ilmenite, mica, phosphate rock, tungsten, lead-zinc ore, iron ores, barite and some for coal cleaning.

Early in the year the plant at Jacksonville, Florida, had been in operation for about nine years and 90,000 tons reputed to have passed each of the rougher spirals which had not been repaired or replaced in any way. This represents an extremely low rate of wear. On the other hand, at Trail Ridge, where abrasion of all iron equipment presents a serious maintenance problem, the original spirals cut out in 18 months and have been lined with ¼ in. neoprene sheet.

Spirals are also being used for recovering high specific gravity minerals from flotation tailings and are worth considering as scavengers after standard table plants in some instances.

The spiral sections can now be obtained in Ni-hard Chrome white iron, or in moulded rubber where abrasion is likely to provide a maintenance problem.

Some interesting papers have appeared in the recent Paris symposium, namely a discussion by A. Wack on the use of the Hancock jig for rejecting waste before fine grinding, the results obtained being compared with those possible when a dense media separation is employed. Papers describing the operation of Humphreys spirals and the Buckman tilting frame on wolfram ores in France and the use of the Minemet tilting slime frame as used on the Puyles-Vignes wolframite mine also contain interesting data. The Minimet frame (shown on this page) has been described by J. Ferraud and is essentially similar to the Buckman table but the pockets in the rubber deck covering are triangular in shape. Recovery of −10 micron particles is said to be very low indeed on wolframite and feed is all under 75 microns (200 mesh).



Minimet tilting frame in washing position

An interesting appendix to this paper describes the study of subsieve sizes as well as an hydraulic elutriator and centrifugal air separator which have been tested against the Infrasizer. The centrifugal air elutriator, known as the Bahco and made in Sweden, is considered to be the most reliable of the three methods.

Magnetic Separation

The relative merits and demerits of the disc and cross-belt types of magnetic separator have been discussed by P. Saurel in an interesting paper before the Paris symposium. He suggests that the disc machine is better for fine material. Some interesting modifications of the disc surface are described which are designed to break up the curtain of magnetic material which may develop and disturb the active part of the bed.

This is achieved by making the ridges on the underside of the disc in a helicoidal form or by breaking the continuity of the magnetic ridge by inserting strips of non-magnetic material. In spite of the ease of adjustment of the disc machine coupled with the possibility of a smaller air-gap, many operators prefer the cross-belt machine and for the separation of columbite in Nigeria the modern cross-belt separator is more generally used in spite of higher cost.

Flotation

Some interesting work on the power and stability of frothers has been carried out by S. A. Wrobel with interesting results. It is claimed that froth stability of a frother depends upon: (a) the concentration of the frother; (b) the size of the air bubbles; (c) the affinity of a frother molecule for water; (d) the viscosity of the frother in the surface film and in bulk; (e) the boiling point of the frother; (f) the temperature of the system; (g) the rate of absorption of frother molecules at the air-water interface; (h) the nature of the film formed; (i) the difference in the equilibrium surface tension between the solvent and the frother; (k) the size of the non-polar group and cross-section area of the molecule.

On the other hand he suggests that the frothing power depends on the following: (a) the structural constitution of its molecules: (b) the distribution of electrical field within its molecules; (c) its solubility in water; (d) its rate of absorption at the air-water interface; (e) its surface activity; (f) its equilibrium surface tension; (g) the viscosity of the surface film and in the bulk.

The influence of frothers upon the grade of flotation concentrate has also been investigated by Wrobel who shows that both recovery and purity of concentrate are influenced by the type of frother used.

G. Sitia (Paris symposium) has described the flotation of oxidized lead ores in Sardinia and states that the advantage of stage addition of a sulphidizer seen in the laboratory has not been found to be true in practice. Furthermore, when sodium sulphide alone is used there is sometimes a tendency to produce CO_3 ions and thereby increase the pH, resulting in a barren froth. When this is so the use of sodium sulphide and sodium hydrogen sulphide is better as the latter causes the formation of sodium bicarbonate limiting the pH.

The concentration of calamine ores was also discussed by Maurice Rey and Paul Raffinot at the same session and the paper gives considerably more details than can be found in a similar paper before the I.M.M. symposium last year, reagent consumption and metallurgical results being quoted. The procedure is unusual and involves the preliminary flotation of oxidized lead by normal means using soda ash, sodium silicate, sodium sulphide, sodium hydroxide, amyl xanthate and pine oil, but, in the zinc circuit, flotation is achieved by using more sodium sulphide along with sodium silicate, a special colloid gangue depressor and an amine as collector. 86.4 per cent of the lead and 73.3 per cent of the zinc is said to be recovered with a cost of under Fr.200 per tonne.

A. Desnoes and R. J. Testut have also described some work on the employment of silicones for silica flotation and showed that a mixture of chlorsilanes was successful as a collector. The technique consisted of grinding the ore, desliming, drying and conditioning dry with the vapour followed by flotation in the ordinary way.

Cyanamid have announced a few new reagents such as

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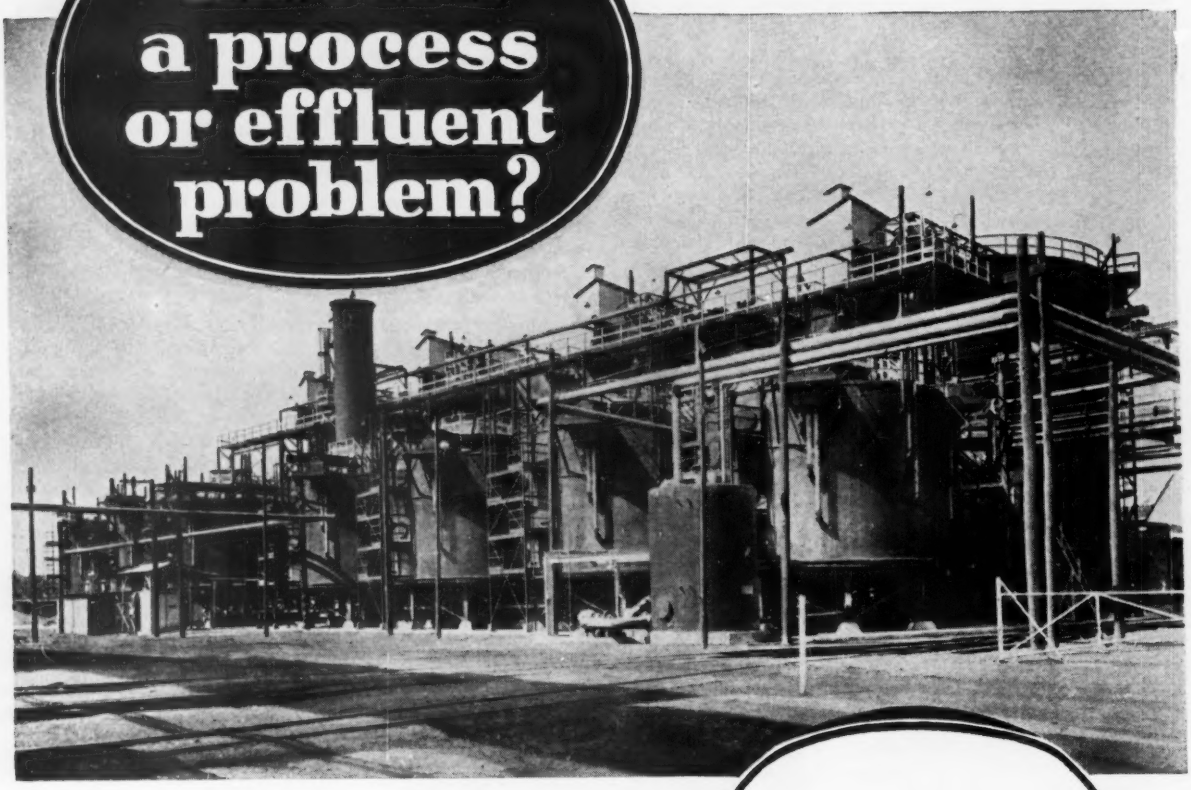

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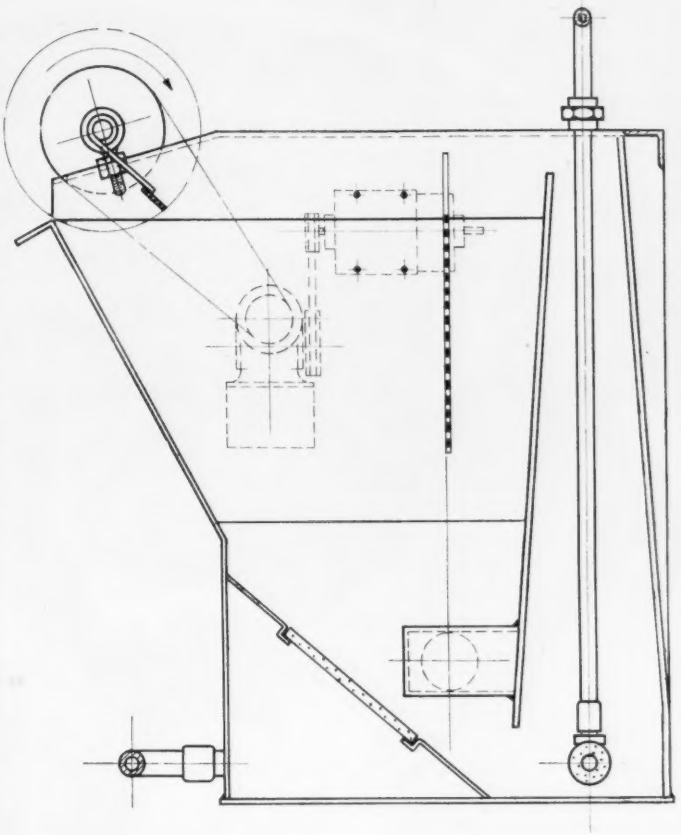
Aerofroth S 2065 and S 2075 which are said to be long chain compounds and are cheaper than many older types. Reagent 675, a cyanogen compound, has also been found to be a good depressor in the separation of lead and copper sulphides as well as for depressing copper and iron minerals whilst still allowing molybdenite to float rapidly. In some cases this reagent gives better separation and a cleaner concentrate than a straight cyanide or cyanide/lime treatment.

A series of flotation reagents are now being offered in this country by Float Ores Ltd., including a series of xanthates as well as other collectors and frothers. R.510, R.511, and R.572 are sulphydric reagents having a complex aromatic hydrocarbon chain and are recommended for the flotation of oxides and oxidized minerals, such as malachite, cerrusite, etc., as well as for treating heavily oxidized copper sulphide minerals. They are said to dispense with the necessity of a sulphidizer and act equally well in an acid or alkaline circuit, whilst they will tolerate high concentrations of various soluble salts. R.106 and R.107 are collectors developed for selective barite flotation and R.128, R.130, and R.276 are long chain sulphonates. R.130 is recommended for iron oxides, garnets and mica, whilst R.128 and R.276 are for removing impurities from glass sand. Like the Cyanamid 800 series, they are generally used in an acid circuit with conditioning at a high pulp density.



Sectional view of new flotation unit manufactured by Knapp and Bates

Flotbel 402 and 403a are collectors for non-metallic minerals and based largely on internally combined aromatic aliphatic components which offer much fewer points of attack by electrolytes and can be rendered highly selective by carefully controlled addition reagents. These reagents are said to act without heat, so often necessary with fatty acids in the case of fluorite flotation, and to need no water softening. A line of cationic collectors is also made, some being quaterary amines and others primary amines. Frothers W, Z, and D are of the synthetic non-iogenic class, a type growing in popularity, whilst Depressant 60 has been recently developed for the selective depression of calcite, dolomite, and silicates in the flotation of fluorite and other non-sulphide minerals.

A new flotation machine has been announced by Knapp and Bates which is of the air-lift cascade type and consists essentially of an air-lift situated at the rear of the cell provided with a horizontal ceramic diffusor fixed to the end of the drop-pipe which circulates the pulp in conjunction with a perforated baffle to conduct the pulp downwards. At the same time the perforations allow the froth to pass forwards to the front of the cell, where it is removed by conventional paddles.

In addition a ceramic tile is provided at the front of the cell for additional aeration and to prevent settlement on the bottom during circulation, the air control on this aerator being separate from that controlling the air-lift.

Cell to cell circulation is provided in the usual manner by means of a weir at the end of each cell connecting to the bottom of the air-lift compartment of the next cell so that it is possible to adjust the pulp level in each cell. The units are made having the same dimensions as the corresponding Sub-A cells so that they are interchangeable.

Dewatering

From time to time a great variety of continuous filters have been introduced, including special modifications for dealing with fast settling solids such as a pan filter, band filter and top feed drum filters. To these has been added yet another design by the Hardinge Co. and is known as a Tray belt filter. It is somewhat like the old rubber band filter but utilizes a series of perforated trays arranged to form a belt and supports a filter cloth which moves with, but is not attached to, the trays. At either end of the system the cloth leaves the trays and is carried on separate idler pulleys so that it is only in contact with the trays on the upper side of the belt. The trays are arranged in sliding contact with a suction box for filtrate removal. The feed enters at one end of the conveyor or belt and the filter cake is lifted out of the trays at the other end as it runs over the top idler so that it is discharged at substantially the same level as the feed entry.

Roasting

The staff at Giant Yellow Knife in the North-West Territory of Canada have published some results of their roasting work on difficult pyrite-arsenopyrite concentrates using an Edwards furnace as well as a new Dorr Fluosolid reactor. The Fluosolid roaster now has two roasting compartments which have greatly improved the unit on this ore.

Leaching Techniques

We have seen a great expansion of hydrometallurgical techniques in the last few years and one of the latest developments is ammonia leaching for treating oxidized zinc ores which cannot be treated by normal means. Most of the minerals are either soluble in the hydroxide or in a mixture of this and the carbonate, whilst although both copper and iron are dissolved, purification is relatively simple and precipitation of zinc can be done by heating.

At Lake Lynn in Manitoba, Sherritt-Gordon Mines are providing an ammonia leach plant for nickel recovery. After a copper concentrate has been produced by flotation

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a nickel rich concentrate carrying 11 to 14 per cent Ni is made and leached with ammonia at a temperature of 150 to 220 deg. F. and under a pressure of about 125 p.s.i. After washing, the solution is boiled to precipitate copper and the nickel removed by precipitation with hydrogen at a high pressure and temperature. The National Lead Co. are also planning to use the Chemico process in order to treat 50 tons per day of copper-nickel-cobalt concentrate.

One of the early plants to be started was the Howe-Sound cobalt recovery plant at Salt Lake. This plant uses an acid leach in autoclaves and although the chemistry is reported as being sound, certain mechanical problems are delaying full scale operation.

Copper—The new Chuquicamata sulphide plant was put into operation this year and with its 30,000 tons per day capacity is one of the largest and most modern copper concentrators. In Cuba the Ncaro plant has also gone into production again with the ammonia leach process.

At the Greater Butte Project the operating results check closely with test work carried out for the past five years.

Lead and Zinc—An interesting development was seen at the Britannia Mining and Smelting Co. operation when flotation failed to give a satisfactory answer to deleading a copper concentrate either with cyanide or with dichromate and best results in the laboratory were achieved by using gravity. As a result a table plant has been installed which is satisfactory, although the capacity is low. In view of this double decked tables are now being installed in order to increase throughput.

Molybdenite—During the year Climax Molybdenum Co. have been enlarging their plant and when complete at the end of 1954 will have a capacity of 25,000 tons daily. Additional plant started in 1951 to deal with the tailing has been described, in which spirals are used to make a gravity concentrate which is then floated to remove pyrite, the non-floating fraction re-treated on tables, passed through wet magnetic separation to remove iron, dried and treated to dry magnetic separation making a tungsten concentrate which is cleaned by flotation.

The tailing from these separators is then re-treated magnetically, recovering monazite which is finally cleaned by flotation and the final non-magnetic product floated again for sulphide removal and the cassiterite recovered on tables. Although the treatment is most elaborate, it serves as an example of what can be done with minor amounts of valuable minerals in a tailing.

Uranium—In this field the greatest expansion has been on the Rand where plants are being erected at Daggafontein, Vogelstruisbult, Luipaardsvlei, West Rand Consolidated (the pioneer in this work), Randfontein, Stilfontein, Blyvooruitzicht, Western Reefs Exploration, Welkom and at President Steyn. Properties in the Orange Free State are also said to be interested. The process is partly secret but is largely a question of acid leaching using manganese dioxide as an oxidizing agent, followed by purification of the leach solution and final precipitation of the uranium.

Columbite—Considerable interest is being shown in the columbite in Nigeria and a number of mines are building or adding to their existing dressing plants in order to recover more of this valuable mineral which a few years ago was nothing more than a liability to the tin producer.

The development of the primary columbite deposits is also under way and Amalgamated Tin Mines of Nigeria started a pilot plant in the autumn. Concentration is by gravity jigs making a low grade concentrate which carries numerous other minerals such as tin, ilmenite, zircon, monazite and thorite. This product is finally dressed by a succession of processes involving wet gravity treatment, magnetic separation, electrostatic separation and concentration on pneumatic tables.

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Extraction Metallurgy

By GRAHAM OLDHAM, B.Sc., F.R.I.C., D.I.C. M.Inst.F.

IN looking back over the year 1953 it cannot be said that there have been any very spectacular advances made in the field of extraction metallurgy. This is true, at least, of the published work although a few tantalizing rumours have emerged from time to time. It has been said, for example, that Imperial Chemical Industries have a new process in operation for the production of titanium. Neither a confirmation nor a denial of this rumour has been given although it is quite clear that an intensive search for an improved process is going on. As far as American production of this metal is concerned it has been implied[1] that the Kroll process is still being used, the only modification being the operation of bigger and better reactors.

Carbon Reduction Processes

In recent years the carbothermal process for the production of magnesium has been receiving attention. A process covering certain specialized techniques in this method has been the subject of a recent British patent.[2] Magnesium oxide and carbon are reacted in the absence of air or foreign gases at 1,100 to 1,300 deg. C. and the vapours produced are then diffused through nests of concentric porcelain or alumina tubes, the vapours at each stage being pumped back to the preceding stage. Eight diffusion stages result in the production of magnesium vapour containing less than 0.1 per cent of carbon monoxide. By this method it is claimed that almost pure magnesium can be obtained.

A method for the continuous production of zinc has been claimed by Breyer and Delruelle.[3,4] Briquettes containing between 30 and 40 per cent of coal or coke and 70 to 60 per cent of calcined zinc concentrates are fed into a travelling grate furnace heated to 1,600 to 1,700 deg. F. Humidified air is blown through from below and the hot zinc-containing gases are shock chilled to yield 85 per cent metallic zinc and 10 per cent zinc oxide. The effluent gases have a composition of 12 to 13 per cent carbon monoxide, 10 to 11 per cent carbon dioxide, 5 to 7 per cent hydrogen, 3 to 4 per cent water, 3 to 5 per cent zinc, any remainder being nitrogen. The shock chilling may be carried out by whirling the gases tangentially into a mixing chamber along with a cool, non-oxidizing gas. The gases are finally filtered to remove the zinc dust.

The production of rare earth metals such as cerium from silica containing minerals which contain easily reducible metal compounds forms the subject matter of a recent Austrian patent.[5] The raw material is melted down with a reducing agent and the resulting slag drawn off and decomposed with such an amount of acid that the rare earths are almost completely dissolved. As an example of this method 1,000 kg. of a cerite ore analysing Ce_2O_3 46.6 per cent, SiO_2 26.4 per cent, Fe_2O_3 15.2 per cent, CuO .4 per cent, were mixed with 38 kg. of comminuted coke. The mixture was then melted down in an electric furnace and the slag continuously drawn off. This slag was poured into a mixture consisting of 2,000 litres of hydrochloric acid and 3,000 litres of water and agitated. The solution was then filtered from the silica, evaporated and worked up to yield the metal.

Hydrogen Reduction Processes

Most of the world's supply of molybdenum is obtained from the United States in which country the most important single source is that at Climax, Colorado. The treatment of the ore and fabrication of the metal has been reviewed by Jones.[6] The final molybdenum flotation concentrate in the form of the sulphide is converted to oxide in circular hearth type furnaces. The operation is autogenous and the temperature is controlled by drawing air across the hearth. Since the oxide begins to sublime at 600 deg. C. and melts at 800 deg. C. the temperature must not be allowed to rise too high otherwise excessive loss by volatilization will result. This technical molybdic oxide produced is then purified by volatilization in a single hearth dough-nut type electric furnace, the hearth temperature of which is approximately 1,000 deg. C. The volatilized oxide is collected in bags at the outlet of a metal flue and has a purity of 99.975 per cent. The molybdic oxide may then be reduced by a two-stage hydrogen reduction to molybdenum. The first stage :

$$MoO_3 + H_2 = MoO_2 + H_2O$$

is carried out at about 600 to 700 deg. C. and the second stage :

$$MoO_2 + 2H_2 = Mo + 2H_2O$$

at about 950 to 1,100 deg. C. This two-stage process avoids the formation of a coarse metal powder which tends to be produced by the action of water vapour. Variation in the reduction conditions, for example changing the time, temperature or rate of hydrogen flow causes a variation in particle size of from .1 to 6 microns.

It is, perhaps, appropriate here to refer to an authoritative account of molybdenum resistor ovens by F. Regel.[7] These ovens are used for the hydrogen reduction of molybdic oxide, tungstic oxide, ferric oxide, cobalt oxide etc. as well as for annealing or sintering metal powders. Industrial molybdenum resistor ovens have a load value of 15 W./sq. cm. compared with .6 W./sq. cm. for chromium alloy resistor ovens. Carbon monoxide gas in the oven has no deleterious effect upon the resistors and the ovens will operate satisfactorily with an atmosphere of hydrogen, cracked ammonia, partially oxidized hydrocarbon gases or under vacuum. Ovens with molybdenum resistors have been made for the reduction of oxide powders at 1,050 deg. C. with a production of 70 tons per month and smaller ones for the manufacture of tungsten powder operating at 950 deg. C. and with a production of 1 ton per month. Conveyor types of oven have also been made handling a production of 25 to 50 tons per month as well as vacuum ovens for the production of very pure metals.

Vapour Phase Reduction

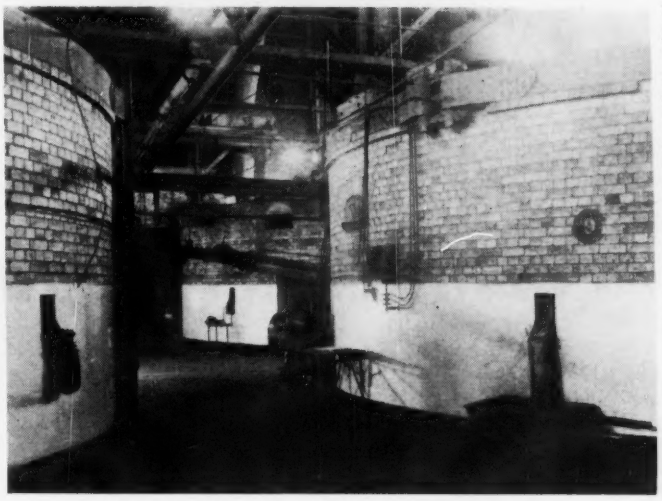
In recent years there has been an increase in vapour phase reduction methods especially for those metals with difficultly reducible oxides. The production of vanadium from the vapour phase has been described by Jantsch and Zemek.[8] Vanadium tetrachloride is first purified by distillation at between 180 deg. and 190 deg. C. Hydrogen is then passed through the purified chloride heated to 125 deg. and the gas stream passed into the reaction vessel which is preheated to 700 deg. C. At the same time hydrogen is introduced from the opposite side of the chamber, producing eddies which accelerate the reaction. The resulting powder is 99 per cent pure, hydrogen being the only impurity. This may then be removed in high vacuum at 560 to 850 deg. C. giving a vanadium powder with a particle size of .2 to .3μ.

The Use of Metallic Reductions

Reminiscent of the Kroll process for the production of titanium is the method claimed by J. F. Jordan.[9] Titanium tetrachloride is the starting point and is reduced with magnesium in a molten bath of magnesium chloride maintained at a temperature above the boiling point of magnesium. The titanium tetrachloride in the gaseous or liquid state is introduced into the bath immediately over the point at

which the magnesium is introduced, either in the form of gas, liquid or powder. The titanium powder produced is dispersed throughout the salt bath and the mixture of molten magnesium chloride and titanium is withdrawn from the bottom of the reactor. The titanium is separated out either by settling or centrifuging, followed by distillation or treatment with cold dilute hydrochloric acid and water. Alternatively the titanium is allowed to sink to the bottom of the reactor and the molten salt, increased in amount by the products of reaction, allowed to overflow at the top. Agitation produced by the injection of an inert gas such as helium prevents the formation of sponge metal. It is not essential to use magnesium, sodium and potassium are also suitable. In this case, however, additives must be used in the bath as the boiling points of the alkali metals are close to those of their chlorides.

The use of aluminium scrap in the recovery of lead has been claimed in a British patent.[10] Galena or other sulphide ores are mixed with 7.5 per cent aluminium scrap and heated in an inert atmosphere until the reduction commences. The aluminium is converted to sulphide and the temperature is maintained at 900 to 1,000 deg. in order to facilitate the removal of the lead.



Huntington-Heberlein rotating hearth calciners

(By courtesey of the Mond Nickel Co. Ltd.)

Methane Reduction

A new technique in the reduction of metal oxides has been claimed by the Mond Nickel Co. Ltd.[11] in which roasted copper and nickel matte is first partially reduced by methane. The actual process is carried out by passing the crushed calcines down a vertical pipe countercurrently to a stream of natural gas. The pipe is heated externally to between 580 deg. and 1,040 deg C. when at least 88 per cent reduction of the oxide is effected. A small amount of carbon is deposited on the metal, the cooling of which is effected partly by the entrant gas and partly by water jacketing around the lower part of the pipe.

The Iodide Process

The Van Arkel-de Boer process for the production of metals, although of no great commercial interest, is still of value in preparing high purity zirconium or titanium. Normally iodine is used as a carrier, the iodide of the metal not normally being isolated. Last year, however, saw the patenting of a production method for high purity, oxygen free zirconium or titanium iodides suitable for thermal dissociation to the metal.[12] Commercial flake iodine in amount equivalent to 3 lb. per hour per sq. ft. of reactor area was sublimed and passed upwards through a vertical graphite or quartz tube reactor containing ½ in. lumps of zirconium cyanonitride held at between 950 deg. and 1,050 deg. C. The zirconium iodide which is formed is condensed at 200 deg. in a stream of helium or argon. By varying the condensation temperature and the diluent rate, various particle sizes may be obtained. There is a 96 per cent recovery and in the production of titanium iodide a 95 per cent recovery.

Nash and co-workers[13] have described the production of vanadium by the iodide process and also by a similar process in which iodine and undissociated iodide are pumped off at low pressure. Vanadium produced by the normal iodide process must be melted prior to use but in the latter process it is directly utilizable. As might be supposed, iodide vanadium is extremely ductile and may be cold rolled to 90 per cent reduction before annealing.

Electrolytic Methods

Although there has been an increase in the use of carbothermal methods of reduction of the oxides of the more electropositive metals, electrolytic methods are still of the greatest importance. A method for the production of aluminium by fused salt electrolysis has been claimed by Hans Grothe for the Société Anon. pour l'Industrie de l'Aluminium.[14] The fused salt bath contains aluminium chloride 46.3 per cent, potassium chloride 33.3 per cent, lithium chloride 13 per cent and magnesium chloride 7.4 per cent, to which may be added small amounts of sodium chloride or lithium fluoride to improve the electrical conductivity. Molten aluminium on the floor of the cell serves as the cathode, the anodes being of graphite. The temperature of electrolysis is between 670 and 730 deg. C. and the cathode current density about 1 ampere per sq. cm. The electrolyte is circulated through a number of cells in series so that during electrolysis fresh aluminium chloride may be added to the cell whilst spent electrolyte is withdrawn.

A cyclic process for the recovery of aluminium from low-grade ores such as siliceous bauxite and kaolinite and from residues such as blast furnace slag has been claimed by A. M. Kennedy.[15] The process is designed so as to regenerate the chemicals used, in addition to reducing the consumption of electrical energy to an absolute minimum. The ore or residue is crushed to approximately 80 mesh and then roasted. One portion of the ground material is digested with sulphuric acid converting the aluminium present into the sulphate. The other portion is digested at 80 to 90 deg. with a solution of caustic soda or caustic potash and the solutions mixed. The amounts subjected to each treatment are so adjusted that after mixing the precipitated iron, titanium and silica may be filtered off leaving the aluminium in solution as the sulphate. The aluminium is then precipitated out as the hydroxide and the residual solution electrolysed to recover alkali and acid.

An interesting method of production of titanium metal has been claimed in a Japanese patent,[16] the fused bath in this case containing potassium chloride 18 per cent, calcium fluoride 2 per cent and magnesium chloride 80 per cent. Titanium tetrachloride is fed into the fused salt bath through perforated cathodes, the anode being of graphite. Electrolysis is carried out with a current of 800 amperes at a p.d. of 6 volts. The metal which collects at the bottom of the cell consists of titanium 83 per cent, magnesium 14 per cent, together with 2 per cent magnesium chloride. The product is compressed at 50 tons per sq. in. and sintered in vacuo for 20 hours at 900 to 1,000 deg. C

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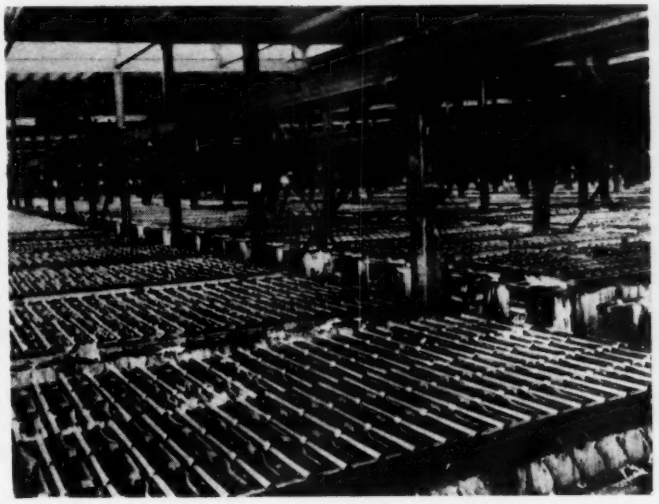
Another electrolytic method for the production of titanium has also been claimed.[17] As before, titanium tetrachloride is electrolysed, this time using a mixed sodium chloride potassium chloride electrolyte. The alkali chlorides, mixed in equal parts, are heated to 675 deg. C. and the titanium tetrachloride introduced under pressure. Air is excluded from the cell and a current of 60 amperes passed. Addition of the tetrachloride is continued for four to five hours and the current passed for a further hour after addition has ceased. The bulk of the titanium is found on the cathode and is of very high purity.

Ion Exchange Processes

There has, in the past decade, been a considerable increase in the use of ion exchange methods, more especially for the production of the rarer metals such as the rare earths. The method is extremely valuable although, of course, the throughput is relatively small. A preliminary note on the treatment of Travancore zircon has been published by K. S. Rajan.[18] The aim of this work was to investigate methods of efficient decomposition of zircon sand without the necessity of preliminary grinding and purification of the zirconia. The zircon sand which was selected contained 67.4 per cent zirconium oxide and showed a sieve analysis of 60 per cent of -120 to $+170$ mesh, 4 per cent of -170 and 36 per cent of $+120$ mesh grains. The sand was fused with 40 per cent excess caustic soda at 650 to 700 deg. C. when 97.5 per cent of the zirconia was recovered. A very high degree of purification of the zirconium was then achieved by the use of a synthetic cation exchanger or a carbonaceous ion exchanger and there was no loss of zirconium.



Electrolytic cells at Port Colborne nickel refinery
(By courtesy of the Mond Nickel Co. Ltd.)

The preparation of pure scandium, not a commercially important metal but interesting because of its relationship to the rare earths, has been described by V. K. Iya.[19] Thortveitite, a scandium containing silicate ore, was heated with 1.2 parts of carbon for 30 minutes at 1,800 deg. C. The carbides of the metals formed are decomposed by acid and the crude scandium oxide purified by precipitation with ammonia and air in the presence of perchlorate at a pH of between 4.9 and 5.5. Alternatively the scandium oxide, which contains 7 per cent rare earths, may be dissolved in hydrochloric acid and passed through an ion exchange column containing Dowex 50. This is followed by elution with a solution of 5 per cent citric acid adjusted to pH 2.7 to 3.0 with ammonia. After a single run the scandium contains less than .5 per cent of rare earths.

The Ammonia Leach Process

An ammonia leach process for the treatment of nickel-copper-cobalt sulphide ore has been described by F. A. Forward,[20] the process being unique in that the cobalt, by hydrometallurgical operations only. Professor Forward, of the University of British Columbia, has been responsible for much of the original research work, while the Chemical Construction Corporation handled much of the engineering and design problems associated with the plant. The process is carried out on a flotation concentrate containing 10 to 14 per cent nickel, 1 to 2 per cent copper, .3 to .4 per cent cobalt, 33 to 40 per cent iron, 28 to 34 per cent sulphur, 8 to 14 per cent insoluble matter together with less than .2 oz. of precious metal per ton. The concentrate is reacted with ammonia, oxygen and water in an autoclave at 125 lb. per sq. in. and 150 to 220 deg. F. when metal ammines, hydrated iron oxide and ammonium thiosulphate are first of all produced. The dissolved oxygen then reacts further with the thiosulphate yielding first ammonium trithionate and then, eventually, ammonium sulphate and ammonium sulphamate, the hydrated ferric oxide, silica and other insoluble compounds being discarded. The second leach takes place in a compartmented autoclave which is continuously operated. Extraction in the first stage is carried out with recycle liquor from the second stage but in the second stage fresh ammonia is used on the partly leached solids. Increasing amounts of sulphate and sulphamate are formed with a lower oxygen intake.

On boiling in a continuous still, the thiosulphate and trithionate are decomposed and the excess ammonia removed. Copper sulphide containing only about 1 per cent nickel is precipitated and the remaining solution contains rather less than .005 gm. of copper per litre, this trace being removed by sulphuretted hydrogen. The thiosulphate, sulphamate and thionate are then removed from solution in order to avoid the production of nickel with a high sulphur content. In the hydrogen reduction stage which follows, nickel is precipitated first since the reaction for its precipitation proceeds more readily than the corresponding one for cobalt. About 1 gm. of nickel is left per litre of solution, this being necessary in order to reduce the risk of coprecipitation of the cobalt which may occur due to overlap of the two reactions. After extensive laboratory and pilot plant research on this technique, a refinery at Fort Saskatchewan, Alberta, was commenced in 1953, which should start production this year.

A somewhat similar hydrometallurgical approach to the problem of the separation of nickel and cobalt has also been patented by the Chemical Construction Corporation.[21] Ore containing nickel and cobalt, together with iron, copper and other metals, is acid leached and metals other than nickel and cobalt removed by standard procedures. To the solution is added the ammonium salt of the acid used, together with sufficient ammonia to bring the pH to between 4.5 and 6.7 when the nickel is precipitated. Sufficient ammonia is then added to the remaining solution to produce a pH of at least 6.8. Metallic cobalt is precipitated from this solution by the action of a sulphur free reducing gas such as carbon monoxide or hydrogen.

Ammoniacal leaching techniques may also be used in the production of copper, especially from low-grade sources. Prakash and Sundaram[22] have investigated in the laboratory the possibility of recovering copper from smelter slags

containing only .3 to .7 per cent copper. Various methods were tried out, the best recovery being obtained by passing a sulphur dioxide-air mixture, ratio 1:2 over the ground slag at between 600 and 650 deg. C. The resulting copper sulphate was leached out to give a 56 per cent recovery. Roasting with ferric sulphate at 550 deg. C. produced a 36 per cent recovery, but if the slag is given a preliminary calcine this may be raised to 45 per cent. An ammoniacal ammonium carbonate leach gives a recovery of 33 per cent, a ferric sulphate leach only 20 per cent.

An ammoniacal ammonium carbonate leaching method has been claimed for the recovery of copper from scrap.[23] The leaching is carried out at 100 to 150 deg. F. when a soft sludge is formed. This sludge may then be treated with acid to remove metals other than copper. Alternatively it may be further treated with an ammoniacal copper carbonate solution having a lower copper content than that used in the original leach. The presence of air, with or without oxygen enrichment, is an aid to the leaching process. Carbon monoxide is added to the solution after filtration[24] so as to reduce the copper to the cuprous state. The solution, at a temperature of 100 to 150 deg. C., is subjected to a pressure of between 75 and 1,000 lb./sq. in. when part of the copper is precipitated in the form of powder of 99.9 per cent purity.

Ammonium carbonate leaching of low-grade zinc ores has been studied by W. J. Wendt.[25] This worker has investigated the influence of the concentration of ammonia and carbon dioxide in the leaching solution as well as the effect of leaching time on the recovery of zinc from smithsonite and calamine. It was found that under suitable conditions an ore containing 3.8 per cent zinc carbonate and 1.7 per cent non carbonate zinc could be leached with ammonium carbonate to effect a 95 per cent recovery.

New Work on Refining

An interesting method for the purification and prevention of segregation in germanium, known as zone refining, has been described by W. G. Pfarn and K. M. Olsen.[26] The method consists in slowly passing a number of short molten zones through a long ingot of the impure metal. By this means the distribution of solute is much more uniform than when the entire ingot solidifies at one and the same time. The technique for preventing solute segregation is referred to by the authors as zone levelling.

K. E. Mann[27] has recently described a method for the refining of magnesium in which zirconium tetrachloride is added to the magnesium melts, the amount added being 8 per cent of the metal weight. This removes iron, silicon and aluminium, as well as some manganese. The zirconium which remains in the magnesium may be removed by hydrogen or chlorine.

The oxidation velocity of antimony in the refining of crude lead has been investigated by Röntgen, Hilgers and Gottschol.[28] The influence of arsenic, bismuth, copper, tin and zinc on the oxidation of antimony and its behaviour under various oxidizing conditions were studied at temperatures between 750 and 800 deg. When other metals are absent the oxidation of antimony in lead follows the law of chemical kinetics of a first order reaction so that with a high antimony content, reaction is more rapid. It was found that the oxidation velocity was not increased by air blowing either with or without removal of slag nor by stirring in litharge. With other metals present the oxidation velocity curve of antimony shows a maximum due to the fact that it is only appreciably oxidized when the other, more oxidizable, impurities have been removed. This maximum in the curve is displaced towards a higher antimony content, the lower the content of other impurities. If, on the contrary, the other impurities present are less easily oxidized, then there is no maximum in the oxidation velocity curve.

The Use of Vacuum in Extraction and Purification

High vacuum is being increasingly used in metallurgical practice, and in the production of ductile zirconium and titanium it is virtually a necessity. During the year a number of papers have been published on vacuum technique, the abstract which follows being typical. A. Davey[29] has discussed the theory of vacuum distillation with particular reference to the vacuum dezincing of lead bullion. The discussion applies not only to the removal of zinc from lead but also to any process where the distilling element has a partial pressure of upwards of 100 microns and the non volatile constituents a partial pressure of less than 10 microns. The evaporating and condensing surfaces must be situated parallel to one another with a vapour path short enough for the resistance of the vessel walls to be neglected. The author states that the distillation rate depends mostly upon the difference in partial pressure of zinc between the distilland surface and the vapour just above the surface. A rise in evaporating temperature raises the vapour pressure of the zinc, increasing this difference and hence the distillation rate. Operating at higher vacuum reduces slightly the vapour pressure of the zinc above the distilland surface and therefore slightly increases the distillation rate. By increasing the vacuum to a point where molecular distillation can occur, there should be a great improvement in distillation rate. If the condenser temperature is raised so that the partial pressure of zinc in the distillate is appreciable, the effect is approximately equivalent to raising the residual gas pressure by the same amount as the partial pressure of zinc in the distillate.

Conclusion

It should, of course, be realized that the field of extraction metallurgy is a highly competitive one and there are many large concerns which rely for their well being solely upon their ability to produce a better product than their competitor. This is especially true of firms which possess no supply of ore of their own. This being the case it is obvious that many of the more important advances do not and cannot find their way immediately into the technical press. This review has dealt only with work that has been published or, at any rate, released for publication ; it does not pretend to do more than this.

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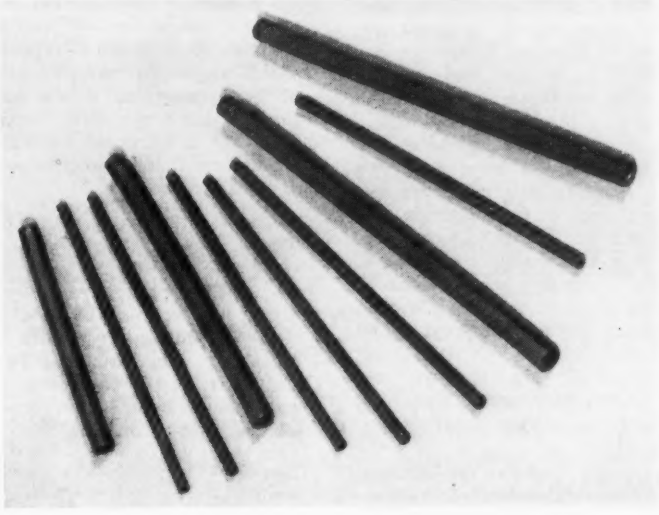
Powder Metallurgy and Alloying

By A. E. WILLIAMS, Ph.D., F.C.S.

DUE to the ease with which powder metallurgy techniques enable porosity in the finished product to be accurately controlled, the large-scale manufacture of filters for a variety of purposes by these methods is being increasingly undertaken. This activity is encouraged by the demand for filtering mediums of greater efficiency than those already available. According to the use to which the filter is put, the metal powders employed include copper, stainless steel, bronze, nickel silver, and other materials capable of resisting corrosion in specific applications. Some of the various applications for these new filters have been described by A. J. Langhammer and P. Glick *(Product Engineering, 179, April, 1953)* and they show that the filters are now in use for filtering mineral oils, corrosive chemicals, compressed air; while they are also applied to flame arresting in electrical equipment and to sound damping. The latter application refers to pneumatically - driven machines wherein the use of powder metal filters in the air escape openings permits an increase in the outlet area; thus giving increased efficiency in the equipment and at the same time decreasing the noise.



Products of powder metallurgy

(By courtesy of Murex Ltd.)

Alloy Steels

Experimental work on the possibility of using chromium-nickel powders made by the hydride process in the manufacture of alloy steels has been undertaken by J. D. Shaw, W. V. Knopp, and B. A. Gruber *(Precision Metal Mouding, 42 and 73, March, 1953)*. The hydride process applied to this involves mixing the pure primary metal oxides in the required amounts to form the alloy; the oxides being then thermally reduced by calcium hydride. This method gives a fine particle size in the reduced powder and a very low oxide content; the particles are of irregular shape and create a porous structure, which blends easily with iron powders and offers no difficulties in moulding. In the tests reported, use was made of 80-20, 50-50, and 20-80 chromium-nickel alloy powders; these being mixed in amounts of 5, 10 and 20 per cent alloy, with electrolytic iron powder; in some cases with the addition of 1 per cent graphite. A compacting pressure of 50 tons/sq. in. was applied and the product was sintered at 1,100 deg. C. for one hour in hydrogen.

As one would expect, the highest tensile strengths were obtained in the sintered material containing the highest proportions of chromium-nickel alloy. For example, a 5 per cent alloy content gave a tensile strength of 42,900 lb./sq. in.; this figure being increased to 61,000 lb./sq. in. with a 20 per cent alloy content.

These experiments also show that the period of sintering has considerable effect on tensile strength. In one example wherein the material consists of electrolytic iron powder, with 10 per cent of a 80 Cr/20 Ni alloy, to which 1 per cent of graphite has been added, a one-hour sintering time gives a tensile strength of 66,100 lb./sq. in., which is raised to 95,300 lb./sq. in. for a two-hour sintering period; the temperature being 1,100 deg. C. in each case.

Tensile strength can also be increased by merely raising the sintering temperature from 1,100 deg. C. to 1,200 deg. C. without prolonging the sintering period. Various forms of heat-treatment were applied to the compacts containing iron and graphite with 10 per cent of the alloy powder. In this way tensile strengths as high as 99,500 lb./sq. in. were obtained. The various heat-treatments applied to the products indicate that this technique represents a practical method of producing alloy steels which compare favourably in strength with steels produced in the normal way.

A method for the impregnation of stainless steel compacts with stabilizing elements has been protected by Metal and Plastic Compacts Ltd. *(Brit. Pat. 694,326)* in which sintered articles made from austenitic stainless steel powder which are to be welded are stabilized by the addition of one or more carbide-formers, one of which is titanium hydride. Upon sintering, the hydride liberates hydrogen, thus leaving the titanium in a chemically active form for reacting with the chromium carbide which is uniformly dispersed in the mass. An exchange reaction takes place between the titanium and carbide, liberating chromium and leaving titanium carbide, and this does not diffuse rapidly during the welding operation. As an alternative to titanium hydride, other stabilizers are zirconium hydride, niobium, tantalum, low-carbon chromium-titanium, and titanium itself.

Magnets

Recently developed magnet alloys have widened the uses to which magnets can be applied and an appreciable proportion of different types of magnets are produced by powder metallurgy methods. These fall into two basic categories, those made from pressed and sintered powders of normal particle size, and magnets made from powders of ultra-fine particle size.

In the U.S.A. during the past year work has been carried out to develop a method for improving the properties of Alnico five magnets, performed as a result of the observations that the magnetic quality of such materials is affected by the as-cast macrostructure. Single-crystal specimens of the nominal composition: iron 51, cobalt 24, nickel 14,

aluminium 8, and copper 3 per cent, have been produced by special sintering and grain-coarsening methods, to permit the effect of crystal orientation to be studied. The work shows that massive crystals of Alnico alloys may be produced either by slow sintering of fine, non-oxidized powders, or by the coarsening of relatively fine-grained castings. At the Detroit plant of the General Electric Co., U.S.A., eight grades of Alnico-type magnets are now being made and while all these grades can be made in cast form, three grades are also being made by powder metallurgy methods.

According to *U.S. Pat. 2,617,723,* anisotropic permanent magnets having a massive crystal structure are made by compacting and sintering a mixture containing powdered iron, aluminium, cobalt and nickel, at a temperature within the range of 1,200 deg. to 1,400 deg. C. In this, the aluminium must be present as an alloy with a metal of the iron group, and no liquid phase must exist at the temperature of sintering; an aluminium-cobalt alloy is preferred. The composition of the magnet may be: cobalt 16-30, nickel 12-20, aluminium 6-11, copper up to 3 per cent, the balance being iron.

A process for the production of metal powders specially suitable for making sintered alloys of high magnetic permeability has been protected by Standard Telephones and Cables Ltd. *(Brit. Pat. 679,172).* In this, finely divided metals or oxides are prepared by decomposing the insoluble oxalates of metals. For preparing the latter, oxalic acid is added to an aqueous solution of the metal sulphates containing one or more lower sulphates of a metal of varying valency, for example, iron, nickel, or cobalt, in the presence of an organic reducing agent such as formaldehyde, and also enough sulphuric acid to lower the pH to 3 or below. This operation is carried out at a temperature between 40 deg. and 90 deg. C. Oxides are preferably produced by heating the precipitate at 400 deg. to 800 deg. C. in an oxygen-containing atmosphere. Metals are prepared by reduction in hydrogen containing from 0.5 to 10 per cent water vapour. A typical sintered alloy may have the composition: nickel 78.5, iron 17.5, and molybdenum 4 per cent.

Copper

Results of research on copper powders by different workers are recorded by the Copper Development Association (Technical Survey, January, 1953, and January 1954). An experimental study on a laboratory scale of the production and properties of oxide-reduced copper powder has been made, in which copper wire was roasted at temperatures of 800 deg., 900 deg., and 1,000 deg. C. for periods up to three hours. It was found possible to completely oxidize wire 0.007 in. thick in bulk by heating at 900 deg. C. for two hours. The oxide, mainly cuprous oxide, was friable and easily powdered in a small ball mill. Several methods of reduction were tried and treatment of the comminuted oxide by hydrogen for one hour at 400 deg. C. was found to give the best results; slight agitation of the powder being beneficial. Behaviour of the resultant copper powder was compared with that of similarly graded material made commercially by the electrolytic process and by atomization. The mechanical properties of objects sintered from the oxide-reduced powder did not differ greatly from those prepared from the commercial grades; but the flow qualities of the powder itself were inferior.

As a result of examining the effect of surface treatment on the sintering properties of metal powders, one investigator concludes that the addition of phosphorus in the form of ammonium phosphate leads to a marked increase in the tensile strength of copper and iron compacts, amounting to almost 100 per cent under ideal conditions. Using this method, it is possible to produce filters from copper and iron powders with considerably improved mechanical properties. The successful production of aluminium bronzes from freshly reduced copper powder ball-milled with aluminium powder in different proportions, compacted and sintered in pure hydrogen for 32 hours at 900 deg. C., is also reported. At this temperature the aluminium melts and forms with the copper a homogeneous alloy, though some porosity was observed. In reviewing powder metallurgy in relation to the automobile industry, one investigator points out that porous iron skeletons infiltrated with copper or copper alloys can be brazed to steel without the necessity for using a flux.

The interesting fact has been demonstrated that though inter-diffusion and sintering can and do occur together during the processing of copper-nickel compacts, they are not interdependent. It is thought that diffusion is of less importance in the sintering of metals than creep and slip under the small surface forces which come into play as the temperature is increased. From experimental work on copper-zinc compacts, it is concluded that the first stage in sintering under reduced pressure is the transfer of zinc atoms to the surfaces of the copper particles with the formation of the beta phase of the copper-zinc system; almost all the zinc in the compact being transferred in this way. Phase changes on further heating are attributed to diffusion of the metals in the solid state and to volatilization of zinc from the beta phase. It appears unusual that this phase should apparently take such precedence over other phases of the copper-zinc system which could conceivably be formed. Until recently it appears that brass has been regarded as a somewhat intractable material for industrial powder metallurgy, nevertheless it is now being used for practical purposes.

Factors governing the production of sintered strip from copper, brass and iron powders by rolling have been investigated by other workers, and a method for obtaining electrolytic copper powder from anodes of almost any copper-bearing material has been patented *(Brit. Pat. 668,470).* The copper-bearing material includes copper or brass scrap, copper matte, or even copper ore; the method using an acidified electrolyte containing the chlorides of metals more basic than copper, such as, for example, ferrous chloride in hydrochloric acid.

Tungsten

A process protected by Metro-Cutanit Ltd. *(Brit. Pat. 693,815)* deals with the production of binders for sintered tungsten bodies. A sintered body of high specific gravity consists of tungsten and a binder metal of lower melting point which contains at least one metal of the iron group, and from 5 to 50 per cent of molybdenum. The binder may also contain up to 30 per cent of manganese. Suitable compositions, parts by weight, are as follows: molybdenum 1, nickel 6, manganese 2, iron 1; or molybdenum 1, nickel 3, iron 1; or molybdenum 3, nickel 6, cobalt 1; or molybdenum 4½, nickel 5½. Another method by the same company *(Brit. Pat. 679,994)* covers the preparation of tungsten-base products impregnated with tungsten-nickel alloy. Tungsten or tungsten-alloy products of high density, such as used for X-ray shields, are made by impregnating a sintered or compacted tungsten-base skeleton with a tungsten alloy of eutectic composition.

According to another recently protected process *(Brit. Pat. 680,275),* the swelling which occurs when iron-copper compacts are sintered in hydrogen can be mitigated by including up to 3 per cent of tungsten, either as the metal or in the form of an alloy or compound.

Titanium Carbide in High Temperature Components

Progress in the use of titanium carbide as a base material in the fabrication of components for high temperature applications has been made by Versuchsanstalt der Metallwerk Plansee G.m.b.H. There are two methods of producing these materials, by sintering mixtures of titanium carbide

with nickel and cobalt, or by one of these metals, to act as a binder ; and by the impregnation of the titanium carbide base with molten metals. Typical mixes which have been tried out are as follows : titanium carbide 60, nickel 24, chromium 8, cobalt 8 per cent, which showed specially high resistance to oxidation ; titanium carbide 50, nickel 30, chromium 10, cobalt 10 per cent, which at normal temperature showed a tensile strength of up to 54 tons/sq. in. A mix which consists of titanium carbide 60, nickel 32, and chromium 8 per cent, exhibited very high mechanical strength at temperatures as high as 1,000 deg. C.

A process for the manufacture of porous shaped metal articles, such as electrodes for alkaline accumulators, has been protected by Badische Anilin- und Soda-Fabrik *(Brit. Pat. 686,148)*. These components are made by sintering, preferably in a hydrogen atmosphere, and the metal powder used as the starting material is produced by alloying a low bulk density metal powder by contact with the salt of a more electro-positive metal. For example, carbonyl-nickel powder, having a bulk density of about 0.6 kg./L., is heated for one hour at 50 deg. C. in a copper nitrate solution. While still moist, this is passed into a sintering mould to be heated in a current of hydrogen in two stages ; the first stage comprising heating at 500 deg. C., followed by a final heating at 1,000 deg. C. This gives a nickel-copper product having a pore volume of 85 per cent.

Corronel B

Corronel B is the name given to a nickel-molybdenum-iron alloy which has been recently developed, not by powder metallurgy, to provide a useful material which is highly resistant to corrosion. Following initial work in the U.S.A. and Germany, recent systematic study has been carried out in the laboratories of Henry Wiggin and Co. Ltd., which enables the effects of variations in molybdenum and iron additions to be summarized. In general, it has been found that the corrosion-resistance improves with increased molybdenum content. The addition of up to 10 per cent of iron at the 30 per cent level has no appreciable influence on corrosion rates ; but higher proportions of iron quickly lower the resistance. A composition which has been found to be the most useful in that it combines good corrosion-resistance with workability is : nickel 66, molybdenum 28, iron 6 per cent. A typical alloy of this description has the following physical properties : melting point 1,350 deg. C., density 9.24 g./ml., thermal conductivity 78.5 B.Th.U./sq. ft./in./hr./deg. F., mean coefficient of thermal expansion : 0 deg. to 100 deg. C. $= 10 \times 10^{-6}$, 0 deg. to 1,000 deg. C. $= 14.6 \times 10^{-6}$. When annealed and in the form of sheet, this alloy has the following mechanical properties : tensile strength 60 tons/sq. in., yield point 28 tons/sq. in., elongation on 2 in. 40 per cent, Brinell hardness 200, Izod impact strength 70 ft. lb., Young's modulus 30×10^{6}.

These figures show that Corronel B has a strength and hardness comparable with those of alloy steels, while the material has a reasonable ductility and maintains a high proportion of its strength at elevated temperatures. The addition of molybdenum to nickel increases the nobility of the material, so that Corronel B, with a molybdenum content of 28 per cent, ranks as a relatively noble alloy. Because of this, the alloy does not evolve hydrogen easily, even from concentrated solutions of acids. This alloy has aroused great interest in most countries of the world because prior to its introduction there was no metal, other than the noble metals, that could withstand attack by solutions of hydrochloric acid in the heated state.

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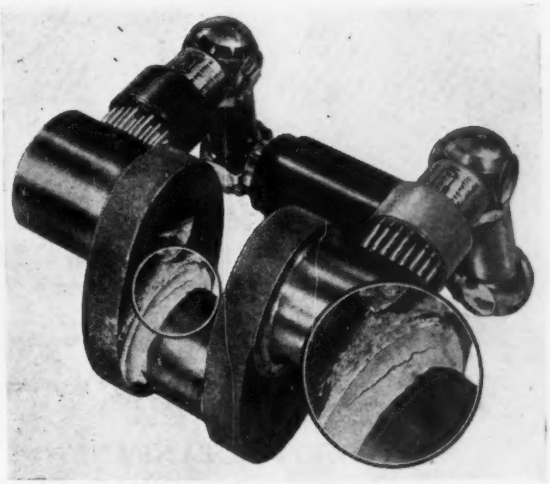

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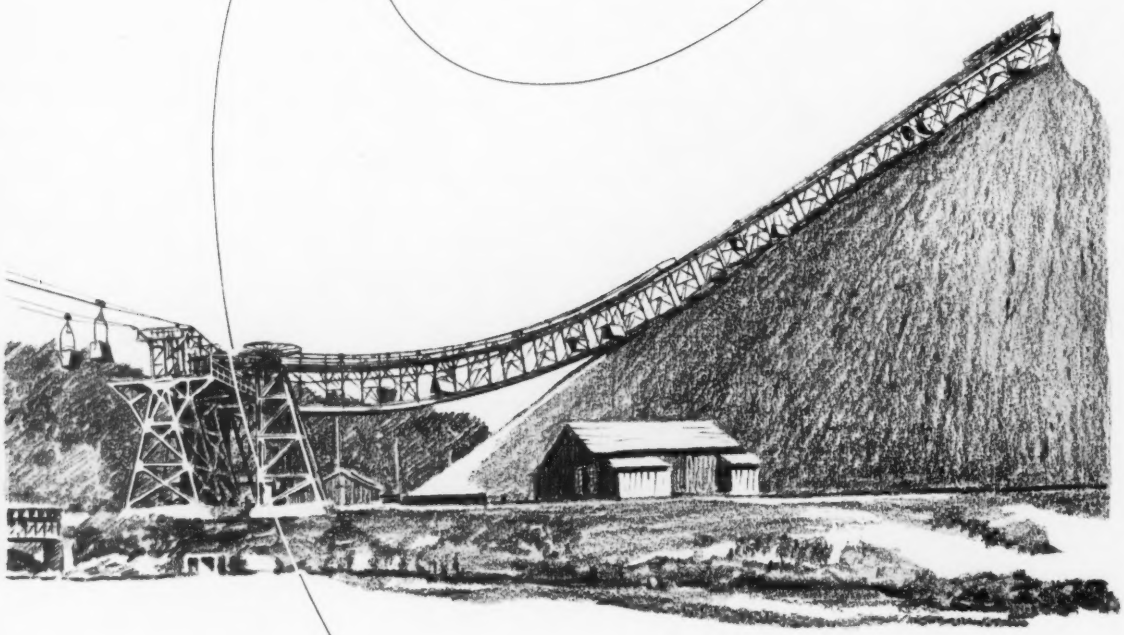

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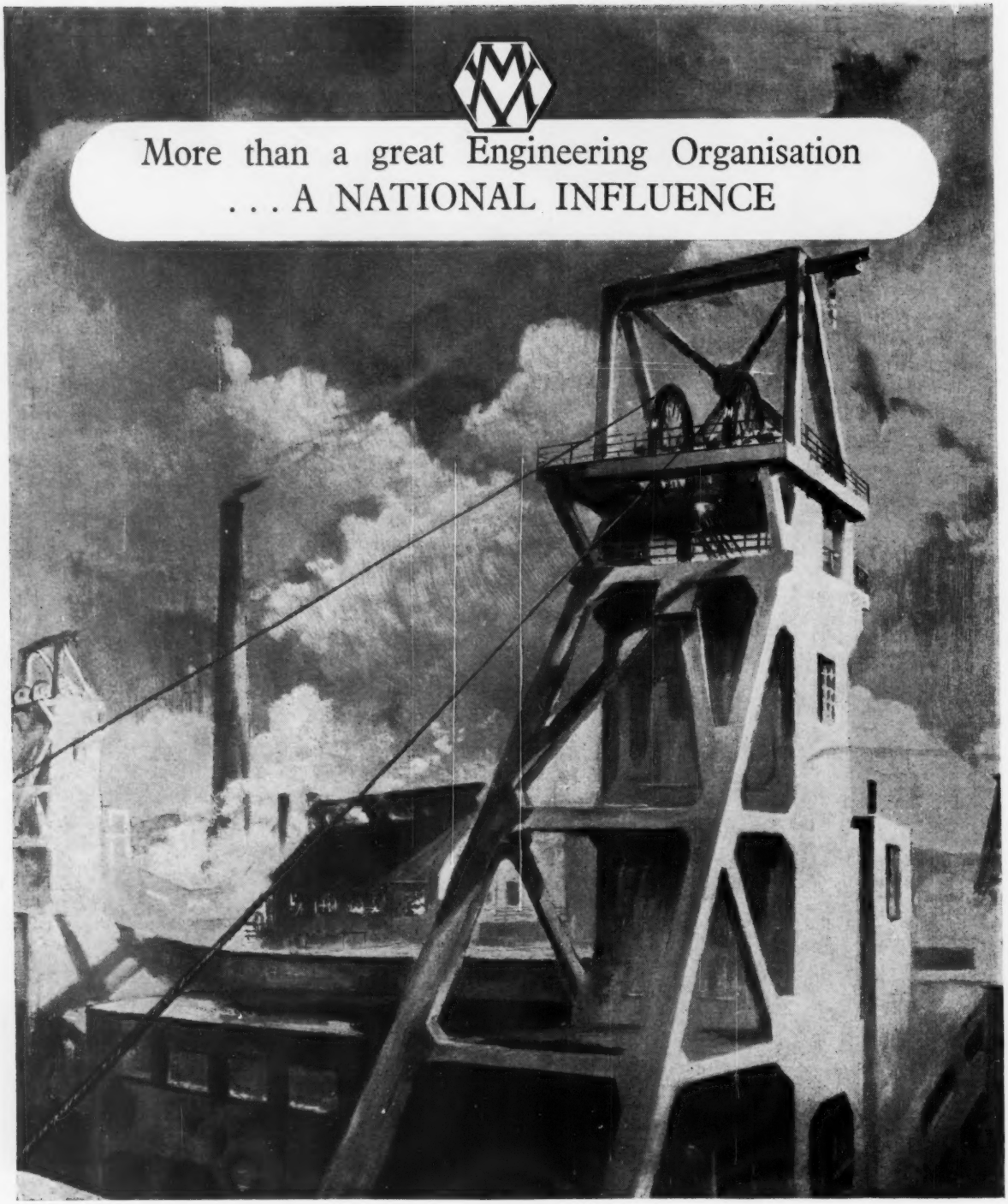

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South Africa

By Our Own Correspondent

ON the surface the operating statistics of the South African gold mining industry for last year suggest that there has been little basic change since 1952. Working revenue shows an increase of under £1,000,000, working costs rose by 1s. 4d. a ton and the working profit fell by 1s. a ton.

The working revenue figure of more than £142,000,000, however, reflects the effect of opposite developments. The first is the falling off in production by the mines of the Witwatersrand proper. The second is the sharp rise in the output of new mines of the Far West in the Transvaal and those situated in the Free State. The actual increase in working revenue from the latter was more than £7,000,000 in excess of the 1952 figure.

Labour and Power Shortages

The fall in the productivity of the Witwatersrand mines was the outcome of continuing shortages of native labour and of power throughout the year, which kept almost every mine operating below its crushing capacity, with the inevitable result that working costs were higher than they need have been. The position in this latter respect was not helped by the effects of continued inflation, although this is slowing down, and hopes are expressed in some quarters that a reversal of the spiral may be just around the corner.

Nevertheless, since the start of 1954 there has been an encouraging improvement in the supply of native labour which is reflected in an increase in tonnages handled and in profits. In addition, the power situation is easing as the Electricity Supply Commission's generating capacity is enlarged, and it is considered likely that all restrictions on power consumption will be lifted by 1956 at the latest.

THE GOLD MINING INDUSTRY'S PERFORMANCE

	1952	1953
Milled, s.tons	60,500,000	**58,772,000**
Yield per s.ton, dwt.	3.767	**3.893**
Working revenue	*£141,271,310	***£142,198,156**
Working revenue, per ton	47s. 1d.	**48s. 5d.**
Working costs	£102,525,003	**£107,306,956**
Working costs, per ton	34s. 2d.	**36s. 6d.**
Working costs, per oz.	181s. 6d.	**187s. 7d.**
Working profit	£38,746,307	**£34,891,200**
Working profit, per ton	12s. 11d.	**11s. 11d.**
Premium gold sales	£3,699,124	**£1,934,421**
Estimated uranium profits	†£125,000	**†£1,828,067**
Dividends	£19,804,928	**£18,207,830**

* Excluding premium gold sales and uranium profits.
† Subject to adjustment.

Premium gold sales fell sharply last year and, unless there is a radical change in the situation, revenue from this source during the current quarter will be at even lower levels. So far as the industry as a whole was concerned this drop was compensated for by profits arising from uranium recovery, but these accrued to individual properties and were not equally spread as in the case of premium sales.

From this it is obvious that good supplies of native labour are more essential than ever during the current year, particularly for the older and lower grade gold mines, if production is to improve and costs are to be kept down.

The Supply of Capital

Another problem, although one which only faces the new mines, is still that of adequate supplies of capital. During last year most needs in this direction came by way of loans against convertible interest-bearing notes taken up by financial institutions and, in the case of the Anglo-Transvaal group, by the Kennecott Copper Corporation of America.

Since the turn of the year, however, the position has eased to some extent as a result of the outstanding values disclosed in development results on a number of the new mines. These served to stimulate share market activity, which has attracted quite a fair amount of risk capital. In consequence, several mining companies have been able to raise funds by the issue of ordinary shares.

There is, however, much more new ground still to be opened up, in addition to the expansion of the existing newer mines. The back of the capital expenditure problem has been broken, but it is reliably estimated that in the Free State alone funds of the order of £80,000,000 will be required over the next 16 years or so to bring the field to its optimum output. This, of course, excludes capital expenditure on uranium recovery plants, the funds for which are provided by British and American loans and are repayable out of profits.

The Impact of Uranium

Earnings from uranium will undoubtedly rise very sharply during the current year, with the original producers getting towards full production and new plants coming into operation. No information is available as to what this figure will be, but it should be well on its way towards the target figure of "in excess of £30,000,000 a year"—the only official indication given to date.

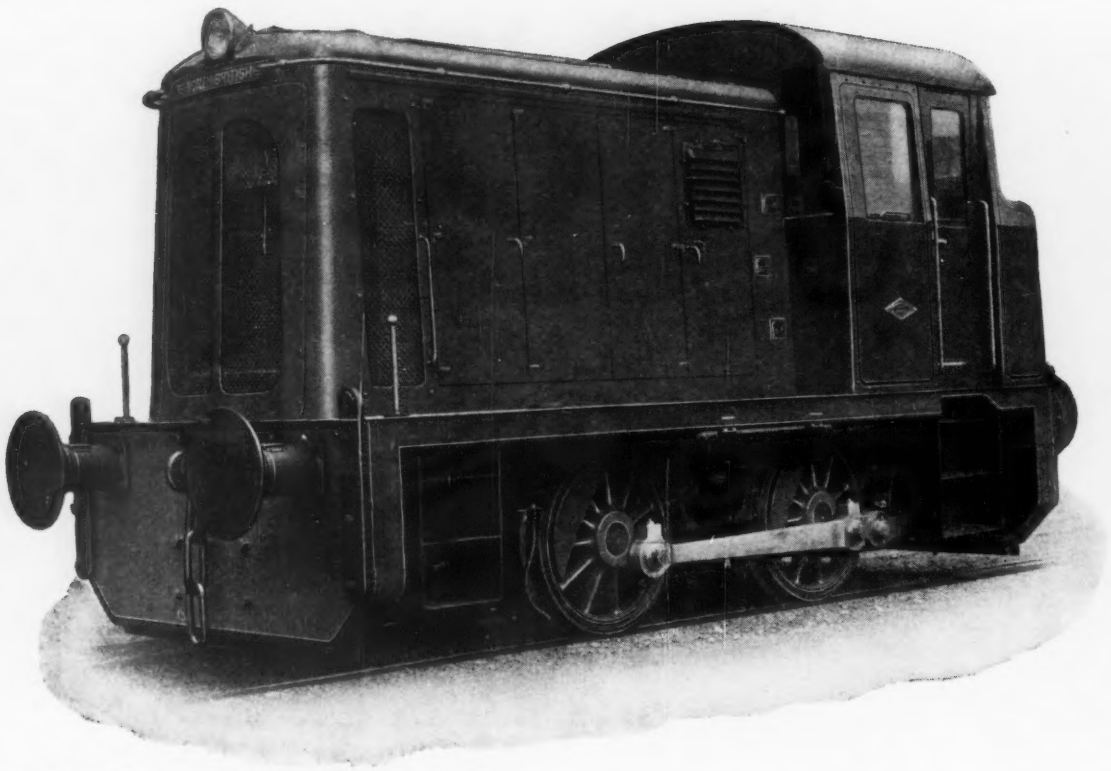
This year will see the start of uranium recovery in the Free State, but it will not be until towards the year-end that it will be possible either to form anything like an accurate assessment of what this work will mean in the way of profits or to draw any comparison with the existing producers in the Transvaal.

West Driefontein got into its stride as a gold producer during the year, with results well up to the original promise. It now holds pride of place as the world's greatest gold mine, although this title may be lost in due course to one of the big Free State properties. This mine is also to recover uranium and its plant will also be fed with slimes from its neighbour, Doornfontein.

Progress in the Klerksdorp Area

One of the most interesting developments in the uranium sphere is the investigation being made in the area to the west of Klerksdorp. Although no figures are available, it would seem that uranium values are such as to justify their exploitation in spite of the fact that those for gold are completely uneconomic. Dominion Reefs has been granted a loan of £2,000,000 for the construction of a recovery plant. No details of how the property is to be operated have been released, but the actual tonnage mined in the past was very small, so it is to be assumed that the treatment of accumulated residues will play an important part. At the same time, prospecting work is being undertaken in the adjoining area to determine whether it would be worth while opening it up for uranium production with a very small output of gold as a by-product.

Big developments have taken, and are taking, place in the Klerksdorp district. Stilfontein G.M. has been steadily putting up new profit records as a gold producer, and the tonnage milled has been rising steadily. In the last quarter of 1953 the uranium recovery plant was started and this is



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being extended to treat slimes from neighbouring smaller properties. Ellaton G.M. started up officially in January this year and earnings so far are proving most encouraging. It will be recalled that this is a "grass-roots" mine with the only known outcrop of the Vaal reef series on its property.

With the completion of the joint shaft of Vaal Reefs and Western Reefs, both these mines are developing on the Vaal reef with most satisfactory results. It has been decided to go ahead with establishing Vaal Reefs as a large independent producer. The revival of the sharemarket made it possible for the company to go ahead with a share issue, raising £3,500,000 which will get the mine well on the way to the production stage, which should be reached early in 1956 with an initial milling capacity of 65,000 tons a month, to be increased to 75,000 tons as soon as possible thereafter. The mining lease covers 6,918 claims. In addition, the mine is to be a uranium producer.

Hartebeest and Buffelsfontein on the Way

Good progress has been made with the opening up by Anglo-Transvaal Consolidated of Hartebeestfontein G.M., which lies immediately to the south of Stilfontein. The initial funds for this undertaking were almost entirely in the form of interest-bearing loans, although the subsequent revival in the sharemarket made a successful issue of ordinary shares possible. The policy was laid down at the outset that expenditure on anything not directly aimed at the maximum production of gold within the shortest time was to be kept at a minimum. Two important consequences developed from this. First was the substitution of concrete headgears for the conventional steel type, and second the complete equipping of the shaft simultaneously with sinking operations. The new type of headgears represent a saving in time and materials of anything up to 50 per cent, and the shaft-sinking technique will allow of underground development to start up immediately sinking is finished, thus eliminating the interval of several months which is the case where equipping is done after the final depth is attained. It is expected that a start will be made with the haulage connecting the two shafts during the second half of this year.

Work is already under way on the Buffelsfontein mine which lies to the south of Hartebeestfontein and is controlled by the Strathmore group, and the end of the year should see shaft-sinking well on its way to completion. No official announcement has been made about this mine becoming a uranium producer, but in the light of the general uranium content of the Vaal reef it seems a foregone conclusion that they will come under the scheme.

Transition from Development to Full Production in O.F.S.

The majority of the new Free State mines are in the transition stage between development and full production. By the end of the year there should be 11 reduction plants operating, leaving two still to reach this stage—Jeanette and Merriespruit. Recent development values have fully justified the optimistic view engendered by the original borehole results that this field would carry gold values well in excess of those encountered on the Witwatersrand and that payability would run at a high level. Indeed, from underground development done so far it is clear that a highly mineralized belt with values of 1,000 in.-dwt. and over traverses the properties of F.S. Geduld, Western Holdings, President Brand and Harmony, and, in spite of considerable faulting in some areas, the eventual extraction values are likely to turn out to be the world's highest.

Actual recovery in the O.F.S. at the present time is still below that which will be obtained, as all mills are being fed a percentage of development rock—varying from mine to mine depending on the number of stope faces opened up—which has a pay-limit of approximately one-third of normal run of mine ore. This position will gradually correct itself, but in the meantime the extraction of gold, although not yielding great profits, goes far towards meeting running costs until this transitional stage, which is predominantly one of development with auxiliary production, is passed.

New Mines To Come

Depending on the state of the capital market, two other major areas can be expected to open up sooner or later—Saaiplaas and Van den Heevers Rust. Saaiplaas, which will come under the control of the Consolidated Gold Fields group, lies immediately north of Harmony and drilling has revealed a number of most encouraging values. Van den Heevers Rust, which lies to the west of Freddies, and is underlain by the so-called "Rainbow Reef," will be opened up by Anglo-Transvaal. Renewed exploratory work on the Dankbaarheid-Erfdeel area is to be undertaken arising out of indications of a possible high level of uranium deposition.

The Water Problem

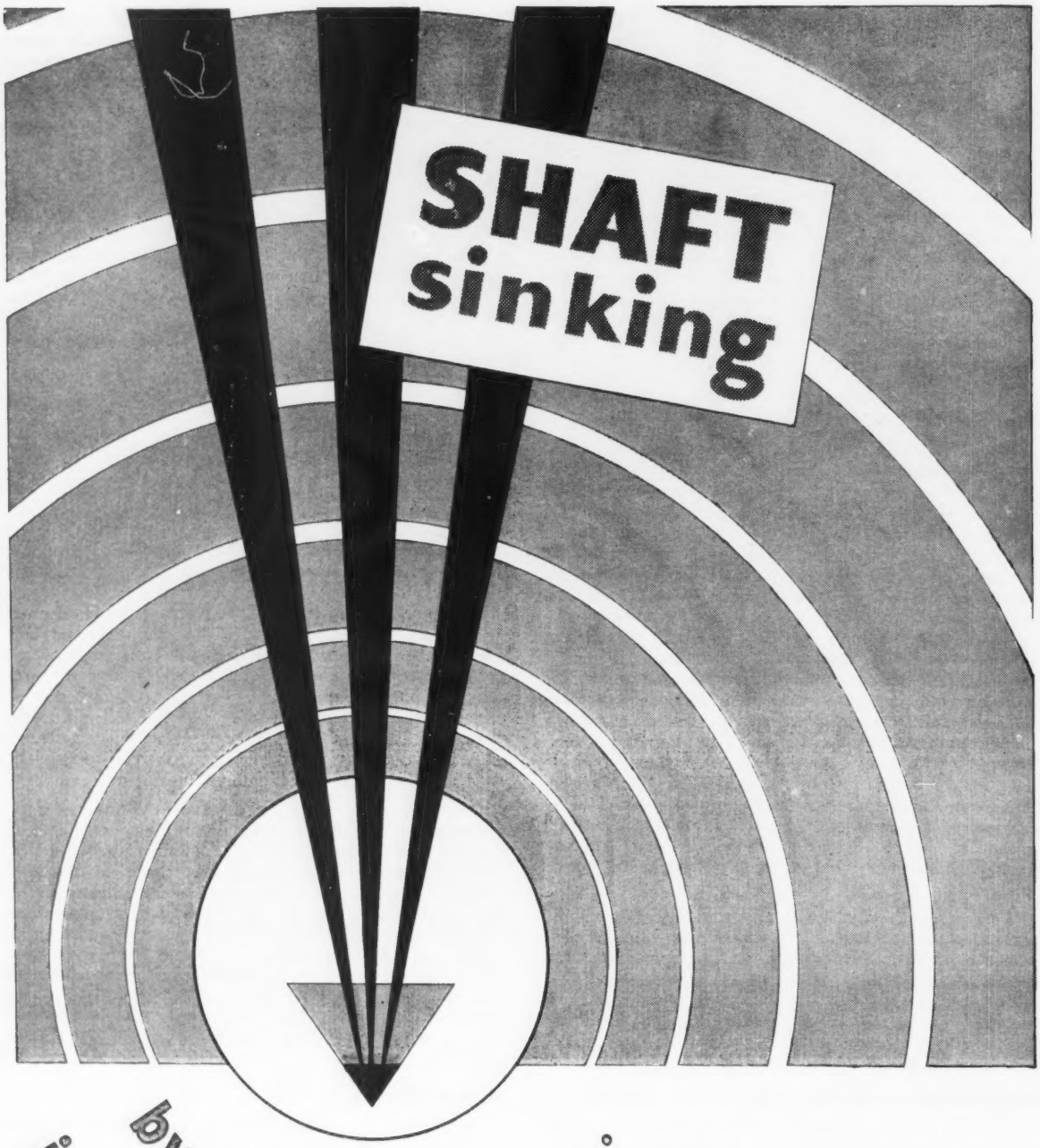
Although water continues to be encountered in relatively large quantities in most of the Free State mines, the experience gained and the precautionary techniques developed have very appreciably reduced both the risk to life and the danger of operations being delayed. This problem is closely related to faulting in the area, for without it water would not be a serious matter. The faults do not only supply the channels from higher reservoirs, such as the base of the Karroo series, but may also store up large amounts of water themselves. The traverse faults are the principal carriers, notably those with an east-west trend, where the dyke that fills them being susceptible to intensive decomposition along its contacts, results in a natural waterway.

Intensive study of faulting in the Free State is being made, closely coupled with keeping the planning of mine layouts on a flexible basis. It is becoming clear that a considerable amount of this faulting is in the "intelligent" category—that is, that it has retrieved reef that was getting too deep for practical mining. At Western Holdings, for example, the reef has been brought back three times to the same level. Another aspect is that had the great downfaulting not taken place in Welkom's western boundary, the valuable ground of Western Holdings, Free State Geduld and Freddies South might have been lost in the erosion which took place before the Karroo series was deposited.

Base Metal Mining

As in the case of gold mining, the statistical information of other mining activities suggests little fundamental change as the total value was only fractionally below the record level of 1952—£48,294,000 against £48,373,000. Nevertheless, there have been some quite appreciable changes in the contributions of the various sections. Sales of coal achieved a new high of £16,464,000 against £14,640,000, largely as the result of an increase in the coal price. Chrome realized £2,661,000 compared with £1,716,000, and manganese £4,371,000 compared with £3,797,000. These particular improvements can be attributed in some measure to the increased supply of railway trucks over the year.

Copper output was actually higher, although earnings showed a drop of more than £2,000,000 to £9,275,000 as a result of the drop in the metal price. Tin production almost doubled itself through the increased outputs on the part of the older mines and the coming into operation of new ones, but the value was £967,000 against £869,000. All going well, production should increase further, bringing this country



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to the position of being independent of imports and possibly a small exporter.

Collapse of Asbestos

The most serious deterioration, however, has been in the case of asbestos where the boom of 1952 fizzled out suddenly. This was directly due to the world market becoming more competitive, and here a major influence undoubtedly was the lack of an efficient marketing system, poor grading and the lack of experience of operators and those in control. It is to be recorded with regret that the great majority of the new undertakings established over the previous few years have fallen by the wayside, and production during the current year is likely to drop still further. The estimated value of production last year was £4,660,000, an estimated decline compared with 1952 of just short of £3,000,000.

BASE MINERAL SALES
(in s.tons)

	1951	1952	1953
Antimony	28,211	11,229	**9,450**
Asbestos—			
Amosite	49,845	58,032	**37,282**
Blue	36,900	40,954	**29,185**
Chrysotile	14,489	24,680	**17,073**
Chromite	564,017	458,785	**597,493**
Coal	28,737,000	30,038,000	**31,371,021**
Copper	38,533	37,606	**37,584**
Iron Ore	1,560,277	1,933,186	**2,136,576**
Manganese ore*	704,133	709,248	**805,565**
Tin	808	997	**1,430**

* All grades

Iscor is making good progress with the opening up of the new rich iron ore deposits in the Postmasburg district which also exist on ground owned by Associated Manganese. Work has ceased owing to lack of capital funds after encouraging progress had been made towards the exploitation of the titaniferous iron ores of the Eastern Transvaal by means of the Krupp-Renn process.

Production of platinum metals totalled 299,177 oz. in 1953, with the full effects of the increased capacity of the Rustenburg mines being felt. Good progress is also being made with the erection of the matte treatment plant which is expected to be completed by the middle of this year.

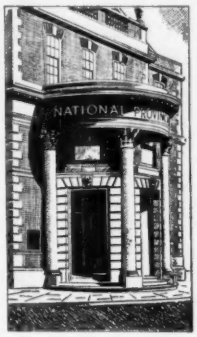
Progress in South-West Africa

Judging by events over the past year it would seem that the earlier high hopes that large and valuable base mineral deposits would be discovered and opened up in South-West Africa were on the optimistic side. It is understood that the Bethlehem Steel Corporation, which was investigating the possibility of extensive iron ore deposits, has started reducing staff and is likely to abandon the work before long. The exploratory work into the existence of coal measures has been fruitless, only low-grade seams having been found at uneconomic depths.

During last year manganese earnings ran at a high level but the indications are that there may be some difficulty in maintaining grade in respect of large tonnages.

On the other hand, the Tsumeb Corporation continues to do well with its lead-copper deposits and it is expected that before long a start will be made with the extraction of germanium oxide from concentrates.

Production on the part of Uis Tin is being stepped up and the target figure of 1,000 tons of ore a day is reported to be not far off. Work is also continuing towards the exploitation of tantalite-columbite existing in the pegmatites.



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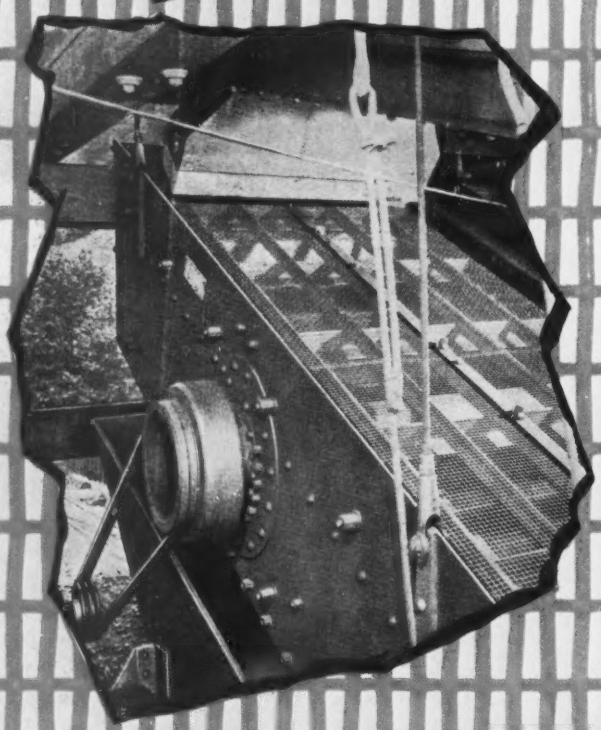

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The Rhodesias

By Our Own Correspondent

ANY review of Rhodesian mining last year must be dominated by an appreciation of the effect of the new Federation of Rhodesia and Nyasaland on the industry and, perhaps more important, the effect of the industry, particularly that predominant section of it situated on the Copperbelt, on the new economic and political set-up in British Central Africa. It is obvious that the considerable mineral wealth of the Rhodesias will form the main pillar of the Federal economic edifice for some years to come. It will therefore be readily appreciated not only how important is the mining industry to the future prosperity and happiness of the Federation, but also how heavy is the burden of responsibility borne on the shoulders of the industry in the vital, formative years ahead.

The mining industries of Southern and Northern Rhodesia are territorial responsibilities. That is to say they are not liable to legislation by the Federal Government. But on the other hand, the control of imports into, and exports from, the Federation, and the promotion of exports, are matters under the jurisdiction of the Federal Government. Added to this are the broader implications of Federation, notably for the relationship between labour and management, and between black and white. Indirectly, then, the advent of Federation can be expected to touch upon multifarious aspects of life and industry in the territories under review, and it goes without saying that in a multi-racial society such as exists in Central Africa much will depend on the early years and the decisions taken in them.

SOUTHERN RHODESIAN MINERAL OUTPUT

(in tons sold)

	1951	1952	1953
Asbestos	77,663	84,834	**87,739**
Chromite	330,989	861,839	**463,030**
Coal (raised)	2,535,449	2,821,221	**2,886,443**
Tungsten (conc.)	235	430	**388**
Beryllium ore	1,110	1,186	**1,774**
Limestone	293,904	435,033	**460,369**
Mica (block waste and crude)	384	747	**155**
Iron Pyrites	31,161	21,002	**40,417**
Petalite	—	—	**11,580**
Magnesite	16,330	12,073	**10,824**
Lepidolite	—	—	**7,682**
Copper	105	120	**211**
Tin (conc.)	95	57	**47**
Tantalum (conc.)	—	5	**14**
Iron ore	57,149	71,465	**69,478**
Amblygonite (conc.)	—	—	**336**
Dolomite	—	5,985	**5,460**
Copper ore	—	—	**293**
Columbite ore	—	0.56	**3**
Arsenic	84	568	**416**
Fireclay	1,201	9,200	**11,600**
Antimony ore	137	229	**53**
Quartz	—	2,507	**2,176**
Quartzite	363	338	**259**

(Arranged in order of financial importance in 1953)

SOUTHERN RHODESIA

Mineral production as a whole in 1953 was valued at £19,491,445, compared with £20,201,282 in the previous year, £15,084,654 in 1951, £13,606,706 in 1950, and £11,293,201 in 1949. Although these figures reflect an apparent decrease in production and values during the year, it should be remembered that in 1952 some £2,500,000 worth of stockpiled chrome was declared, thus enabling the value figure for that year to be described as a record.

The gross output of the mining industry since the commencement of operations in Southern Rhodesia was at the year end valued at £313,476,456, of which £198,388,089 was the total value of gold outputs (including all premium payments), £125,997,936 was due to base mineral production, and the balance came from silver, diamonds and other precious metals.

Difficult Asbestos Position

Asbestos maintained its position, gained the previous year, as the Colony's most valuable mineral export, despite a marked deterioration during the year in market conditions. The worsening of the asbestos position has been regularly punctuated by the closing down of one property after another as a result of falling prices. There does seem to be a realization, however, that Rhodesian producers have got to provide a fibre which not only meets the requirements of manufacturers, but which also is more competitive in price. It was not surprising, in view of the circumstances of the industry, that positive action was taken, mid-way through 1953, to form an association for the purpose of establishing contact with asbestos consumers and thereby to promote direct marketing of Rhodesian fibre. In the meantime the Government agreed to assess and collect royalty on asbestos only after sale.

Gold Industry Declines

The feeling of despondency in the gold mining section of the industry continues, and the disclosure by the president of the Rhodesian Mining Federation at its annual meeting last October, that the number of gold producers in Southern Rhodesia had fallen from 792 in 1943 to 166 in 1953, emphasizes this unfortunate decline, particularly in the small-working section of the industry. Matters were not improved when in November it was announced that the minimum guaranteed price of gold had been reduced by 4s. 3d. a f.oz. to 244s. As was to be expected, gold sales declined last year to £6,440,236 (£19,679 less than in 1952) despite a higher production figure of 501,057 oz. (4,327 oz. more than in the previous year).

Coal Shortage on Way to Being Eased

Progress made at Wankie since the Anglo American Corporation took over seems to be satisfactory, and a further increase in the amount of coal raised there was recorded in 1953 (2,886,443 tons compared with 2,821,221 tons in 1952). The colliery company's expansion programme, which aims at an annual production of 5,000,000 tons by the end of 1956, is making good progress, so much so that the future level of coal supplies in the Rhodesias may now be viewed with more confidence. An increase in output of 50,000 tons a month is promised by the middle of this year with the coming into production of No. 3 colliery, and by the end of the year a more substantial increase is anticipated.

Worthy of note is the formation of a company, com-

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Antimony Ore	Copper	Lithium Ore
Arsenic	Dolomite	Manganese Ore
Asbestos	Felspar Ore	Magnesite
Barytes Ore	Fire Clay	Mica
Bismuth Ore	Fluorspar	Ochre
Beryllium Ore	Iron Ore	Quartz
Chrome Ore	Iron Pyrites	Quartzite
Columbium Ore	Kaolin	Tantalum Concentrates
Coal	Limestone	Tin Concentrates
Tungsten/Scheelite Concentrates		Vermiculite

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prising well-known Southern Rhodesian small-workers, which is to extend prospecting work at the Entuba coalfield, four miles from Wankie. If results show that there is a sufficient quantity of commercial grade coal at fairly shallow depth, the company is expected to raise further capital in order to develop the project.

Selection Trust's Lithium-Beryllium Project

The results of the investigation being made on a lithium-beryllium property in the Bikita area, near Fort Victoria, will be awaited with considerable interest. The Selection Trust subsidiary which is engaged on work at Bikita has already proved a considerable tonnage of beryl ore and large, high-grade lithium-bearing deposits.

Chrome Bottleneck Eased

Output of chromite continued at a high level last year, and was a third higher in volume than in 1951. It is also encouraging to record that Rhodesia Railways—for so long the bottleneck in this particular field of mineral production — moved 498,000 tons of chrome last year, in comparison with 295,000 tons in 1952. The 1953 railings fell only 2,000 tons short of the target figure set by the Railways. About 400,000 tons of chrome still lie on the Selukwe stockpile. In the opinion of the Southern Rhodesian Prime Minister, Mr. Garfield Todd, the chrome-producing industry will not have its full rein until the new Bannockburn-Pafuri rail link is completed (it is hoped in 1955), when a fresh outlet to the sea, via Lourenco Marques, will be provided.

The output of tungsten concentrates showed a decline in 1953, when 388 tons were produced, compared with 430 in 1952. The decrease in value of this output was disproportionately large due to the continued decline in price.

N. RHODESIAN MINERAL OUTPUT

(in tons sold)

	1951	1952	1953
Copper (blister)	205,996	200,799	210,061
Copper (electrolytic)	103,146	111,555	152,520
Zinc	22,590	22,890	25,330
Lead	13,970	12,600	11,510
Cobalt alloy ...	1,836	1,249	1,087
Cobalt metal ...	—	32	394
Limestone	169,016	272,094	231,577
Cobalt (other)	—	2	46
Manganese ore	1,260	3,926	7,129
Copper (concentrates) ...	188	5,513	226
Tin (concentrates)	4	16	98
Mica (sheet) ...	6	17	7
Iron ore	—	5,943	2,169
Beryllium ore	—	8	5
Phyllite	5,930	7,522	2,787

(Arranged in order of financial importance in 1953)

NORTHERN RHODESIA

Labour difficulties have cast a long and somewhat blurred shadow over the Northern Rhodesia mining scene. It is true that production records have again been smashed, and that more revenue than ever has been won by the Copperbelt mines, but overhanging all the outward signs of continuing prosperity is the intractable problem of the industrial colour bar and its inevitable repercussions on the industry. It remains to be seen whether or not the latest move by those concerned—four-party talks on the advancement of natives in the industry—will lead to a solution acceptable to all.

Sir Ernest Oppenheimer and Mr. R. L. Prain have made known publicly their views on the subject. On the one hand, the Selection Trust group seems determined to implement some form of advancement for natives as soon as possible, while on the other hand, the Anglo-American Corporation appear to adopt a more cautious attitude.

The African trade union has not shown itself up in the most favourable of lights during the last few crucial months. It is impatient and obviously wants and expects some quick action.

The European mineworkers meanwhile advance their policy of "equal pay for equal work," which on the face of things sounds perfectly straightforward, but which in the light of a recent announcement means that, if a native takes over the work of a European, he must not only receive the same wage but also the same housing, allowances and amenities. This is no easy problem to resolve, but it is one on which some conclusive decision must be taken in the near future. On it will largely depend the forward or backward march of the Copperbelt.

Jump in Industry's Receipts

The total value of all mineral production in Northern Rhodesia during 1953 took a further bound forward to £95,014,411—a figure subject to adjustment—compared with the revised 1952 figure of £78,880,363. For comparison, and to illustrate the phenomenal rate of progress in the Territory's output, figures in previous years were: 1951, £72,161,125; 1950, £49,323,357; 1949, £35,579,543.

The output of blister copper rose last year to 210,061 tons, compared with 200,799 tons in 1952. That of electrolytic copper showed an increase from 111,555 tons in 1952 to 152,520 tons last year.

A striking advance is recorded in cobalt metal production, which is approximately 12 times as high as it was in 1952, some 394 tons being produced compared with 32 tons.

Hydro-Electric Power

The Federal Government's announcement in March this year that it has agreed to commence the Kafue River hydro-electric scheme before the Kariba Gorge and Shire River schemes has met with general approval, particularly as the Prime Minister, Sir Godfrey Huggins, indicated that the Government would commence the Kariba scheme before the Kafue project is completed.

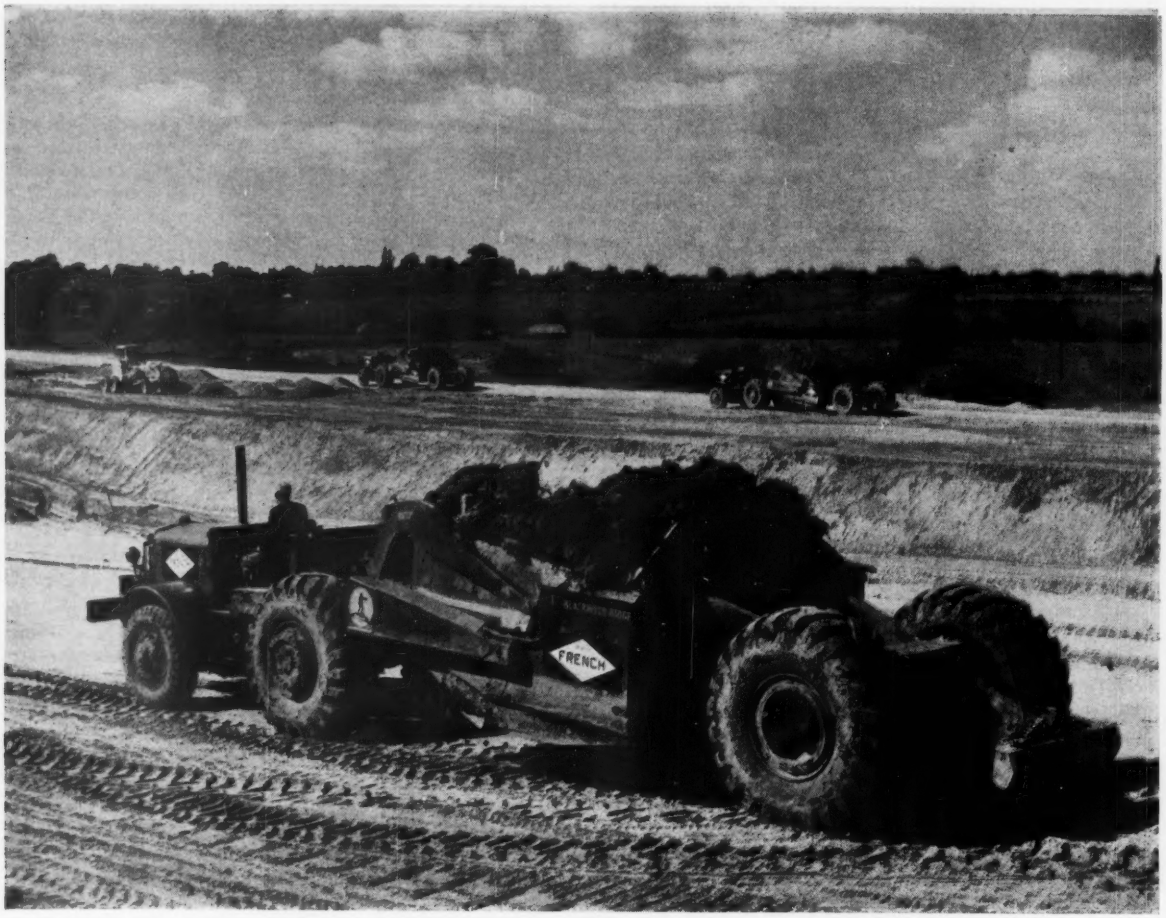
It is thought that the Rhodesias will need 4,000,000 tons of coal a year by 1962 for electric power and other requirements for the copper mines. This figure is 50 per cent higher than the present output of Wankie and only 1,000,000 tons less than the anticipated output of the colliery in 1957. Without hydro-electric power an almost impossible burden would be placed on the admittedly inadequate railway system.

The New Copper Mines

Interesting news during the year was the decision of the copper companies of the Selection Trust group to transfer their residence from London to Lusaka. As the chairman, Mr. Prain, has pointed out to shareholders of the Roan Antelope and Mufulira companies, the change of residence will have a far-reaching effect on the future of the companies.

The United States Government, through the Defense Materials Procurement Agency, agreed to increase its original unsecured loan to Chibuluma Mines Ltd. from £3,000,000 to an amount not exceeding £5,000,000. The whole of the £5,000,000 is repayable in metals and the American Government is to have a prior option on 19 per cent of Chibuluma's cobalt. It is now thought that production of copper may begin at the mine towards the end of next year instead of in 1956.

During the year the £5,000,000 Bancroft mine company was formed. The intention is to develop and equip the mine to produce about 150,000 tons per month at an estimated cost of £12,000,000. Ore reserves at Bancroft, proved by diamond drilling, total about 80,000,000 s.tons, with an average copper content of 3.6 per cent. At present it is expected that the mine will commence production in 1957. Meanwhile, work has begun on a tarmac road and a railway line which is intended to link Nchanga with the new mine.



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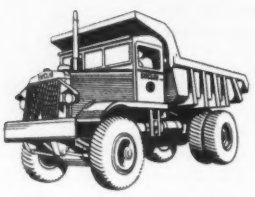

Subsidiary Companies Branches Works and Agencies throughout the World

East Africa

By JACK SPALDING, A.R.S.M., B.Sc., M.I.M.M., M.C.M.M.S.S.A.

FOR the major concerns operating in East Africa 1953 was a period of development and construction. Some programmes have been delayed, however, due to the non-delivery of plant ordered, especially of electrical machinery from Britain. There is a resulting tendency to turn to the Continent for electrical equipment.

The Mau Mau war does not appear to have had any direct effect on mining in East Africa; but there are signs that it has had a deterrent effect on the provision of capital, especially from Canada and the United States. Furthermore, the enormous amounts of capital now being required in South Africa for uranium plants and for the Free State mines, have reduced temporarily the interest of South African companies in East Africa.

In all three countries there has been much interest in pyrochlore deposits, and it seems probable that at least one deposit in each country will become a valuable producer.

TANGANYIKA

In spite of falling prices the value of the 1953 production sets a new record at close on £4,000,000. This production figure is actually £2,000,000 less than the value of the exports for 1952, the latter having been abnormally inflated by the shipment of nearly two years' backlog of the production of the Williamson diamond mine following the settlement of their dispute with the Diamond Corporation.

Increases occurred in the production of diamonds, gold, silver, lead concentrates, gypsum, kaolin and salt.

Activity in prospecting has, however, declined and in two cases operations by large companies have been suspended.

MINERAL PRODUCTION

Tanganyika		1952	1953
Diamonds	carats	331,344	**170,529**
Gold (refined)†	oz.	64,693	**69,886**
Gypsum	tons	495	**1,700**
Kaolin	metric tons	126	**1,223**
Lead concentrates	metric tons	4,837	**6,174**
Mica sheet	tons	107	**78**
Salt	metric tons	16,100	**20,102**
Silver (refined)	oz.	35,899	**41,234**
Tin concentrates	tons	63	**62**
Tungsten concentrates	tons	36	**31**

† Excluding gold and silver in lead concentrates.

Kenya			
Asbestos	tons	348	**150**
Carbon dioxide gas	tons	383	**465**
Diatomite	tons	5,932	**4,378**
Gold	oz.	10,209	**9,590**
Graphite	tons	34	**183**
Gypsum	tons	1,593	**841**
Kyanite (raw and calcined)	tons	8,846	**5,434**
Salt	tons	16,750	**20,886**
Soapstone	tons	231	**155**
Soda ash	tons	118,371	**76,032**
Vermiculite	tons	—	**73**

Uganda			
Beryl	tons	—	**50**
Columbite-tantalite	tons	4	**14**
Gold	oz.	201	**572**
Phosphate rock	tons	4,931	**5,363**
Salt	tons	4,043	**7,517**
Tin concentrates	tons	154	**126**
Tungsten concentrates	tons	132	**159**

Diamonds

The construction of Williamson Diamonds' new heavy-medium plant with a capacity of 7,500 tons a day has proceeded according to programme, and an ancillary concentrate cleaning plant is now being built. These plants are expected to come into operation in the second half of 1954. They contain two innovations—the use of tube mills on the primary feed as washers and removers of clay, and selective grinding in ball mills to reduce the volume of concentrates.

The principal mining unit will be a 6 cu. yd. electric walking-dragline excavator which will feed on to 6,000 ft. of conveyor belting via a travelling hopper and crusher unit. To provide sufficient water a new dam with a capacity of nearly 2,000,000,000 gallons has recently been completed.

The cost of the above scheme of expansion, together with improvements and extensions in the camp, will be of the order of £3,500,000, all of which is being found from revenue. In order to cover this sum production was raised to 25,000 ct. a month at the end of 1953 by temporarily working richer ground.

The value of the Territory's diamond production for the year was approximately £2,000,000.

Gold

The upward trend, though slow, was maintained during 1953 in spite of the diminishing gold premium. Though some of the smaller mines may drop out owing to high costs, the future outlook remains good.

Following capital reorganization and with the active participation of New Consolidated Gold Fields, the Geita Gold Mining Company now has an assured future. The north-east extension of the Geita mine, an orebody previously indicated by a single drill hole, has at last been proved underground. It is proposed to enlarge this mine up to the full capacity of the plant, namely 30,000 tons a month, while developing the subsidiary mines. The latter, which in the past fed into the same plant, will then be considered on their own merits.

A new gold mine in the Musoma district, Kiabakari mine, is now being developed by Tangold Ltd., a local company sponsored by the Colonial Development Corporation and New Consolidated Gold Fields. Substantial reserves of low-grade ore have been indicated by drilling, and underground exploration has been commenced.

The value of the Territory's gold production in 1953 was over £900,000.

Lead

Construction of Uruwira Minerals' 1,500 ton-a-day plant at Mpanda has been delayed due to the non-delivery of steelwork from the United States. This steelwork is supplied under the M.S.A. Agreement. The delay will result in the deferment of the production date until early 1955.

Meanwhile the pilot plant has, by the addition of heavier crushing machinery, been converted to a small production plant. The amount of concentrates shipped in 1953 thus rose to over 6,000 tons, with a value approaching £500,000. The concentrates include appreciable amounts of copper, gold and silver, as well as lead.

Mica

The quantity of sheet mica produced fell considerably, due chiefly to the fall in demand for the smaller sizes and poorer qualities. There was, however, a large increase in the tonnage of waste mica exported. The total value of the exports was over £100,000.

Silver

The production of silver used to depend on the output of gold since no silver mines, as such, are working. However,

the amount of silver contained in the Mpanda lead ore is considerable, and the output of silver exported will increase greatly when this mine comes into full production.

Tin and Tungsten

There has been a slight fall in the production of both these minerals, which in the case of tin is expected to be only temporary. The Kyerwa Syndicate, which is controlled by the Straits Trading Company, have not yet got their 1,000 ton-a-day plant into operation. It is hoped that it will come into production this year.

At Murongo, when the price of tin fell below £600, the Colonial Development Corporation ceased their development and prospecting operations and put in a tributer as a temporary measure. The future of this potentially valuable area depends on the success of the latter and on the price of the metal.

K. C. Mines Ltd., the only tungsten producer of size, after doing a considerable amount of development, was forced to suspend operations when the catastrophic slump occurred at the end of the year.

Non-Metallic Minerals

After six years of testing the kaolin deposits at Pugu, after putting up an expensive pilot mill, after forming a subsidiary company, and after establishing brands and markets for their products in South Africa, the Far East and elsewhere, New Consolidated Gold Fields at the end of the year closed down this operation. The reason for this is thought to have been the present competitively heavy demand for capital and the large profits anticipated from investment in South Africa.

Exports of gypsum to the cement industries of Uganda and Kenya continue, and a small quantity of raw magnesite was exported to Kenya. Trial shipments of crude graphite to the United States, and of kyanite from an African small-worker, were also made during the year.

Coal and Iron

The Colonial Development Corporation have completed their investigations of the Ruhuhu Basin, having proved over 200,000,000 tons of good, extractable coal. Nothing more will be done here for the present as it has been decided that there is inadequate justification for the long railway required.

At Liganga, 30 miles distant, the Corporation have been testing the deposits of titaniferous magnetite, of which at least 10,000,000 tons project above the ground in bold and massive outcrops. Nothing can, however, be expected here unless or until the railway is built.

Prospecting

The D'Arcy Exploration and the Shell Overseas Exploration Companies are investigating the coast of Tanganyika. After a general survey, attention has been centred on the chain of islands off the coast, and a deep test well is to be drilled on Mafia Island.

The Department of Geological Survey made a widespread search by air and on the ground for carbonatites and ring structures. Several such occurrences were found, and one at least, Panda Hill near Mbeya, has since been proved of great interest. Large tonnages with good values of pyrochlore have been inferred.

UGANDA

The year has been one of steady achievement, and in general of gradually increasing output. Amongst the many small-workers and prospectors there was a shifting of interest from tin and tungsten (due to the fall in prices) to columbite and tantalite. The latter minerals occur in pegmatites which are widely distributed in the Ankole district. The interest in these minerals was later damped by the refusal of the buying agents to give cash advances at bonus rates for quantities of less than a ton of concentrates at a time.

Copper-Cobalt

Frobishers, assisted financially by the Colonial and Uganda Development Corporations, have at last been enabled to go ahead with their Kilembe mine, though on a somewhat different plan from that proposed previously. The £2,000,000 scheme for transmitting power from the Owen Falls has been abandoned in favour of generating hydro-electric power locally in the Rowenzori Mountains.

It is proposed to treat 40,000 tons of ore a month and to float a bulk concentrate at the mine. This will be piped to a roast-leach plant situate in the flats below the mountain From here the cobalt oxide will be railed direct for shipment, and the copper concentrate will be carried to Jinja for electric smelting. The smelter is being made big enough to take also the concentrates from Macalder mine in Kenya.

At present, construction work on the camp is in full swing. Work in the mine, which is ahead of construction and which was therefore suspended during the year, will be resumed in the second half of 1954. The construction of the railway to the mine should be completed early in 1955. It is anticipated that production will commence in the middle of 1956.

Phosphates-Pyrochlore

The examination of the phosphate-pyrochlore deposits at Sukulu, near Tororo, has been completed, and an enormous tonnage has been proved by pitting and drilling. The operating company, the Tororo Exploration Company, is one-third owned by Monsanto Chemicals, one-third by Frobishers, and one-third by the Uganda Development Corporation.

As far as mining and the recovery of both phosphates and pyrochlore go, the operation promises success; and at present research is being conducted on the processing and marketing of the products. On the results of this the further development of the project depends.

Large quantities of pure, powdered magnetite will be produced as a by-product, but at present there is no market for this locally.

Meanwhile, from other deposits a considerable quantity of rock phosphate is being mined and exported.

Tungsten

The production of this mineral has not been affected by the recent catastrophic fall in price, as all the producers in Uganda have agreements with the Ministry of Materials to buy their wolfram at 250s. a unit. These agreements expire towards the end of 1957. Construction work on the plants which were being installed is therefore being continued, as a result of which increased output should be expected in the future.

Until Kilembe and Sukulu mines start production, wolfram is therefore still the most important mineral won both as regards tonnage handled and value obtained.

Tin

The slump in the price of tin to below £600 caused a number of small-workers to close down and transfer their interest to columbite and tantalite. The recent partial recovery in the tin price and the difficulty in obtaining the American bonuses for the columbite minerals is now causing a drift back to tin, but a gradual decline in the output of this mineral is, nevertheless, to be expected.

Columbite-Tantalite

There appear to be a large number of pegmatite lenses carrying these minerals in the Ankole district, in places

sufficiently close to each other to offer a considerable tonnage. The grade of the deposits so far discovered is low, but in some pegmatites the proportion of tantalite in the concentrates is high, thus qualifying for the maximum price. Pegmatites also occur in north and west Kigesi district, carrying columbite-tantalite and in at least one area beryl and microlite.

The difficulties of financing the work to obtain a sufficient output to qualify for the bonus, and of determining the relative proportions of columbite and tantalite which so affect the value, militate against the small-worker in favour of company operation. The Billiton Company, through their subsidiary Kagera Mines, have special exclusive prospecting rights over a considerable part of the columbite area, and their prospecting during the current year should show whether there is a good future for these minerals or not.

Gold

There has been an increase in the output of gold due to renewed activity on Busia Goldfields' property in the Eastern Province.

Other Minerals

In addition to the above minerals small exports were made of bismuth, beryl, galena, lithium ore, mica and microlite.

Prospecting

In addition to a host of individuals, three companies are prospecting in Uganda — the Union Corporation, the Electrorail Company of Brussels, and the Rosterman (Uganda) Company.

KENYA

In general 1953 was an unfortunate year, and the value of the Colony's mineral production fell to less than £1,500,000.

Although greatly hampered by the secondment of officers to the Security Forces, the Geological Survey mapped in regional style nearly 7,000 sq. miles of country.

Carbon Dioxide

This interesting and possibly unique natural product is of great purity. It is obtained from a borehole originally put down for water at Esageri, in the Rift Valley. The gas is at considerable pressure and large quantities were drawn off for experimental purposes without indicating any limit to the supply. A lease has now been granted to a local company.

Copper

The Macalder mine, now operated by Macalder-Nyanza Mines Ltd., a subsidiary of the Colonial Development Corporation, produced some 3,000 tons of concentrates from their pilot mill. When this mine comes into full production the concentrates will be smelted at Jinja, in Uganda, in the smelter which is to be erected for Frobisher's Kilembe mine.

Gold

The fall in the production of gold continued despite the assistance given by the government in the form of Development Loans. These loans are designed to carry the greater part of the cost of approved underground development work. They are not repayable until the mine concerned is again able to make a reasonable profit.

The value of the production in 1953 was £120,000, which is the lowest since 1934.

Graphite — Asbestos

Three mines are operating, and in spite of considerable difficulties have all made progress. A small amount of crucible flake graphite was produced.

The fibre mined in various parts of Kenya is anthophyllite, a variety which has been in little demand.

Soda — Diatomite — Vermiculite

Soda ash, salt, and a number of by-products were produced from Lake Magadi in the Rift Valley, by the Magadi Soda Company Ltd. This was once again the biggest mineral producer in the Colony, the value of the output in 1953 approaching £1,000,000.

The production of diatomite from the Rift Valley deposits declined somewhat in 1953.

A small amount of vermiculite was produced for local consumption.

Prospecting

A deposit of pyrochlore at Mrima Hill, near Mombasa, was investigated by the Mines and Geological Department. Very large quantities of rock and soil have been indicated containing encouraging values of niobium and of rare-earth minerals. The work is being continued.

Black sands containing ilmenite were also investigated on the coast, but although large tonnages were indicated the values were disappointing.

The D'Arcy Exploration and the Shell Overseas Exploration Companies have shown some interest in the coastal formations. They have now been granted an Oil Exploration Licence over a considerable area.

INVESTORS IN MINING

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LE COMITÉ DES PRODUCTEURS D'ETAIN DU CONGO BELGE ET DU RUANDA-URUNDI

112, rue du Commerce - Brussels

The Belgian Congo and Ruanda-Urundi

By Our Own Correspondent

THE Belgian Congo is a Belgian colony, while Ruanda-Urundi was placed under Belgian trusteeship by the United Nations, and previously was one of the territories taken from Germany by Belgium after the first World War. During 1953 the value of the mineral exports from the Belgian Congo and Ruanda-Urundi accounted for the bulk of the export revenue from these two territories.

The total (customs) value of exports from the Belgian Congo and Ruanda Urundi amounted in 1953 to Belgian Francs 20,437,877,958, and of this total mining products were responsible for no less an amount than B.Frs. 13,108,837,741, excluding freight charges and re-exports. The Belgian Congolese Franc has the same official value as the Belgian Franc, although the economic position of the Congo is much better than in Belgium itself.

The accompanying table shows the mineral exports from the Congo and Ruanda-Urundi over the past two years, the amounts shown being the customs figures: all weights are nett, no allowance being made for packing.

No figures of any sort are available for the export of uranium, radium, germanium, etc., at the request of the United States Government.

A further mineral product of the Congo mines which does not figure in the above table of exports is coal. This is because coal mined in the Congo is not exported, but is consumed domestically. Coal production in the Congo has been increasing in recent years. In 1952 production amounted to 219,000 tonnes; in 1952 252,885 tonnes; and while no figure is as yet available for 1953 production, this is known to be higher than before.

Latest indications are that mineral production is continuing to expand. In January and February, 1954, the only months of the current year for which figures are so far available, the predominance of mineral products in the Congo's exports was greater than ever: out of a total export figure of B.Frs. 3,024,022,186, mineral products accounted for B.Frs. 1,966,711,973.

MINERAL EXPORTS

	Unit	1952	**1953**
Copper	tonnes	204,788	**208,560**
Cobaltiferous products	tonnes	11,691	**13,538**
Industrial diamonds	carats	10,986	**11,798**
Gem diamonds	carats	530,167	**588,530**
Tin conc.	tonnes	16,030	**20,413**
Tin ingots	tonnes	2,860	**2,904**
Gold	oz.	438,000	**449,000**
Zinc conc., crude	tonnes	92,186	**93,962**
Zinc conc., roasted	tonnes	46,842	**31,397**
Zinc conc., unspecified	tonnes	—	**194**
Zinc metal	tonnes	29	**5,831**
Manganese ores	tonnes	125,092	**183,707**
Tungsten conc.	tonnes	854	**1,023**
Tantalum-niobium ores	tonnes	178	**357**
Silver (smelted locally)	kilos	188	**40**
Cadmium	tonnes	20	**32**
Cadmium (electrolytic slimes)	tonnes	12	**10**
Tantaliferous slags	tonnes	837	**73**
Tantalite ores	tonnes	38	**26**
Various minerals	tonnes	523	**1,970**

The Fall in Prices

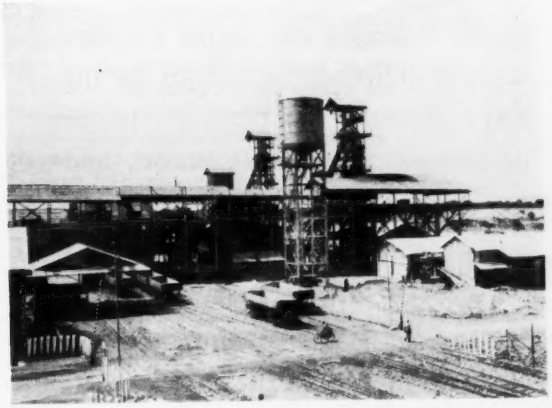
During 1953 the price of most mineral products from the Belgian Congo and of Ruanda-Urundi declined, but the price of copper and cobalt remained stable. Tin experienced a sharp fall, from £962 per ton in March to £566 in July. The price of tin has recovered sharply since then, but may prove too low for many of the producers to work their mines economically. Since expiry of the contract with the American R.F.C. these producers had been forced, owing to the low price of tin, to cease working their mines, and the result was disastrous to the native labour population.

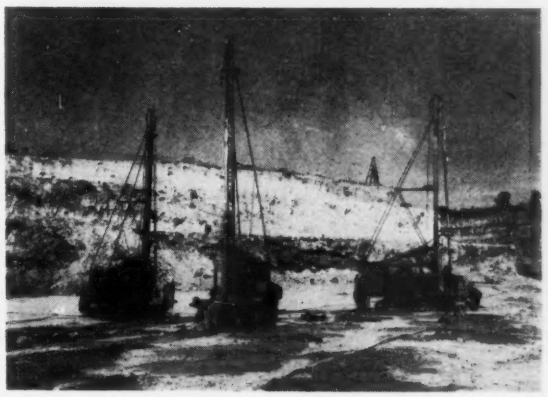
In order to alleviate the position where possible, M. André Dequae, the Belgian Minister for the Colonies, and M. Leo Petillon, Governor-General of the Congo, have reduced the export duty on cassiterite and tin from 11 per cent to 7 per cent, with effect from January 1, 1954.

"Metalkat" Starts Work

Apart from the fall in metal prices, 1953 was notable for the starting up of the first of the two sections of the "Métalkat" zinc works at Kolwezi, Upper Katanga This took place early in the second half of the year, and 8,432 tonnes were then produced, of which 5,831 tonnes were exported, including 2,835 tonnes to South Africa.

"Métalkat" (Société Metallurgique du Katanga) is a company with a capital of B.Frs. 512,500,000. It was founded by the Belgian Zinc Works and the Union Minière du Haut Katanga. Two considerations led to the Belgian





Half Union Minière's copper output (100,000 tonnes) comes from this company's only underground copper mine, the Prince Leopold at Kipushi, near the Northern Rhodesian border (shown in left-hand illustration). The company's other copper properties are worked open cast. The illustration on the right shows blast hole drillers in action on the Ruwe mine.

Zinc Works becoming established in Katanga. Firstly, the presence of substantial zinc deposits in the Colony, and secondly, for reasons of security in the event of Belgium being again attacked and deprived of her domestic smelter output.

The "Métalkat's" present annual capacity for production of cathode zinc amounts to 38,000 tonnes and for slab zinc 36,000 tonnes. This, however, does not prevent the Union Minière du Haut Katanga from continuing to supply the zinc works in Belgium with a good deal of the zinc concentrates they require.

New Hydro-Electric Power Stations

The second section of the Delcommune power station on the Lualaba River (Upper Congo River), came into operation in May, 1953, the third one last January, while the fourth will start working in June.

During 1953 the Union Minière continued the erection of its fourth hydro-electric power station at Le Marinel. It is hoped that the first section will be put into commission about January 1, 1957.

Allowing for an average annual rainfall, these four hydro-electric power stations of the Union Minière will be able to produce 2,500,000,000 kW. a year. This will meet all the Union Minière's power needs, and enable the company to erect further electro-metallurgical works in Katanga, and also ensure that the public utilities have enough power.

As a further consequence of commissioning this fourth hydro-electric power station, Union Minière will be able, after providing for all Katanga's power requirements, to supply up to 500,000,000 kW. to Northern Rhodesia. For that purpose a 500 kilometre transmission line is being built between the Le Marinel hydro-electric power station and the Northern Rhodesian copperbelt. The Kafue River Hydro Electric Authority has entrusted the Anglo American Corporation of South Africa with the design and construction of two hydro-electric stations on the Kafue River, in Northern Rhodesia. These stations will have a potential output of about 2,000,000,000 units a year and it is hoped that power from the Kafue scheme will be available by about 1960. Thanks to the link between the Katanga and Rhodesian power systems, Katanga will, in the event of a dry season, or of any accident to its power stations, be able to obtain power from its Rhodesian neighbour.

It should be added, however, that if the necessity should arise, the Katanga development scheme allows for the possibility of creating two further hydro-electric power stations.

The Bamoco Syndicate

There is little further of interest to mining to report from the Congo, other than that hopes of the discovery of an important copper mine by the Bamoco Syndicate some 50 kilometres east of Madimba (a station on the Matadi-Leopoldville railway) now seem to be fading. A lead and zinc discovery there seems, however, more promising. The Syndicate, however, takes a hopeful view and recently increased its capital to B.Frs. 150,000,000 in order to continue test drilling. It seems likely that the metallic ores already discovered can be economically worked and will more than repay the outlay spent on prospecting. It is also hoped that further drilling may reveal further copper deposits.

Oil

The geological survey undertaken by "R.E.M.I.N.A." (a Brussels company) on behalf of an important Belgian syndicate, to prospect for oil, has been carried out north of the Francqui Port (the western terminus on the Kasai River, of the lower Congo-Katanga Railway). This geological survey is to be continued in the direction of Coquilhatville (on the Congo River, on the Equatorial Line), and also aims at finding suitable places where boring for oil would most likely be successful.

COMITÉ SPÉCIAL DU KATANGA

51 RUE DES PETITS-CARMES, BRUSSELS

The Comité Spécial du Katanga (C.S.K.), which has its Head Office in Brussels, at 51 rue des Petits-Carmes, is responsible for the use and development of land and mining rights belonging to the State domain and to the Katanga Company. These are situated in the Katanga territory as defined in the Convention of 19th June 1900, by which this Committee was created. In the Committee are vested the widest powers of administration, management, and alienation, with no exception and no reserve.

This province, in area twenty times the size of Belgium, is the most heavily industrialised part of the Belgian Congo, and here the white population is at its most dense. This is the result of its important mineral wealth, the excellent communications into the interior and the sub-tropical climate. The C.S.K. representative is based on Elisabethville, capital of the Katanga province.

British West Africa

IN these days of the rapid, but very varied, progress towards self-determination, which is manifesting itself so widely in Africa, British West Africa holds the close attention of the native races throughout the continent. Here, the most dramatic developments in the post-war years have been in the political evolution of the West African colonies, and already, in the case of the Gold Coast at least, it can be said without undue optimism that the moderation, keenness and goodwill shown by the ministers of the colony's Africanized government have largely dissipated the fears of those who felt that the British government was travelling too fast along the road which may eventually lead to Dominion status for the peoples of this part of the Empire.

Politically, Nigeria is also in process of rapid evolution, although less far advanced. It is as yet, however, a little early to judge the success of the new Constitution introduced just two years ago. If the march of political events is the more stimulating to the outside observer, it is by progress on the economic front that the success of these political experiments must to a great extent be judged.

At the moment the most urgent need is for practically all types of building material, and for a greatly increased number of trained technicians. Steps are being taken to establish colleges of arts, science and technology in Nigeria, while on the Gold Coast constructional work is proceeding on the new buildings for the University College and the Kumasi College of Technology. Facilities for higher technical education in West Africa are, however, still largely a matter for the future and the area must long remain dependent on British technical "know-how." Nevertheless, it is clear from the emphasis which is now being placed on these facilities for technical training that the peoples of West Africa are ready to take a long-term view of development of their territories and are beginning to appreciate the advantages of labour-saving machinery.

MINERAL EXPORTS

Nigeria		1952	**1953**
Tin	tons	10,575	**12,136**
Columbite	tons	1,228	**1,855**
Wolfram	tons	47½	**14**
Other metallic ores (lead, tantalite and zinc)	tons	170	**134**
Gold Coast			
Diamonds	ct.	2,051,496	**2,165,345**
Gold	f.oz.	711,096	**730,155**
Silver	oz.	44,116	**44,949**
Manganese	tons	794,192	**745,990**
Bauxite	tons	74,368	**115,075**
Other metallic ores	tons	37	**21**
Sierra Leone			
Diamonds	ct.	452,618	**416,742**
Iron ore	tons	1,152,495	**1,200,240**
Gold	oz. troy	2,591	**3,585**
Chromite	tons	22,490	**26,096**

Total value of 1953 mineral exports from the three Colonies was £37,171,977.

Of the many important developments now envisaged, the greatest, if present plans are eventually confirmed, will undoubtedly prove to be the Volta River hydro-electric scheme. In this connection it should be emphasized that the scheme is not designed to exploit the Gold Coast bauxite deposits exclusively but should, rather, be viewed as a power and irrigation undertaking which, in addition to aluminium production, should pave the way for important agricultural developments and the introduction of many light industries essential to a balanced economy. Plans for a new harbour, at Tema, about 20 miles east of Accra, are also a part of the project.

One matter which is just now very seriously affecting mining enterprises, not only in West Africa but in other countries of the Commonwealth also, is that of taxation, the crippling effect of which is gradually lessening London's former pre-eminence as the world's mining-finance centre. A statement was recently made by the President of the Institution of Mining and Metallurgy to the effect that not a single mining company had been registered in Great Britain for the purpose of developing an overseas mining proposition since 1939. The contrast of this state of affairs with the activity of the mining capital market of London in the late 1930's is even more startling when it is recalled that in the five year period prior to World War II over £100,000,000 was raised in London for mining companies directed and financed from the City, a figure which might perhaps be doubled in terms of present-day values.

GOLD COAST

Early this year the Legislative Assembly of the Gold Coast held its final meeting before its dissolution and the introduction of a new constitution under which general elections are expected to be held in June, 1954. Negotiations with the British Government are, it is understood, still in progress regarding the amendment of the present constitution.

Arrangements have been made for an investment survey of the Gold Coast to be carried out by a team of experts from the United States' Foreign Operations Administration.

Dr. Kwame Nkrumah, Prime Minister of the Gold Coast, in an address to the Gold Coast Legislative Assembly in March of this year, declared that the Gold Coast Government did not envisage any limitation on the present freedom to transfer without restriction profits arising from non-resident capital investment, or to repatriate foreign capital invested in the Gold Coast. Moreover, the government had no plans to nationalize industry beyond the extent to which public utilities were already nationalized. To safeguard against the possibility that later governments may adopt a different attitude, the Gold Coast Government had requested the United Kingdom Government to incorporate in the Constitution an appropriate provision to ensure that if, in the future, the nationalization of a particular industry was considered to be essential, there would be suitable means for guaranteeing fair compensation to the original owners.

Dr. Nkrumah added that he was satisfied there was ample scope for the establishment of many new industries in the country and that they must rely to a large extent on foreign enterprise. While the government appreciated that in industry the criterion must be efficiency it desired foreign firms to engage as many Africans as possible and assist in training them for senior posts. The degree of welcome the government would give to new enterprises would depend on the arrangements made for the training and promoting of Africans. In addition to relief from taxation provided for pioneer industries, consideration would also be given to special assistance for a limited period. It is clear that the Convention People's Party have only the interests of the country at heart and that the government is steering the Gold Coast's nationalist movement slowly but surely towards its objective of full political responsibility.

Mineral exports from the Gold Coast have in recent years suffered considerably from shipment bottlenecks at Takoradi, but the projected new harbour at Tema, together with harbour extension works at present in progress at Takoradi (which latter in itself represents one of West

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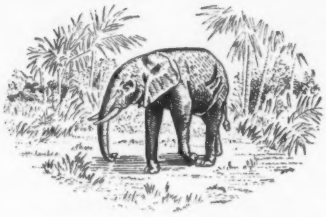

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Africa's major post-war development schemes), and the doubling of the railway track between Takoradi and Tarkwa should eventually solve this problem. A line from Achiasi to Kotobu is also under construction. Takoradi is already handling cargoes exceeding 2,250,000 tons a year.

Exports for 1953 of the principal minerals produced—diamonds, gold, manganese and bauxite—are shown in the table on the previous page. Their value totalled £22,006,828 compared with £23,243,399 in 1952.

The new Minerals Duty which recently came into operation and which is not susceptible of double taxation relief has been a source of much adverse criticism from the mining companies and discussions are to take place with the appropriate authorities with a view to some amelioration of the system.

Those who invest their funds in enterprises that do much to develop overseas resources are justified in their contention that they should not have their burden of taxation increased by a tax that is not only not allowable for double taxation relief but one that increases directly in proportion to the richness of the deposits discovered and the efficiency with which operations are carried on. The present taxation system is one that is hardly likely to encourage further expansion of colonial and other mineral resources.

In this connection it is of interest to note that the one-fifth tax exemption on Australian mining profits is to be continued for a further seven years, i.e. to June, 1960. The exemption applies to certain specified metals and minerals; dividends paid by companies wholly and exclusively out of exempt profits earned from the mining of these products will continue to be exempt in the hands of shareholders.

Gold

Wage increases, coupled with the continued rise in the cost of equipment and stores, have now outweighed the financial advantage derived from sales of gold on the "free market." The disappearance of the premium price is more likely to affect low grade rather than high grade producers as the earnings represent a much higher percentage of their profits.

Nine companies are producing gold from lode mines and one (Bremang) from dredging operations. The labour position is quiet and adequate. Successful efforts have been made to control the general level of the cost of living, and this has contributed to the maintenance of goodwill and contentment amongst the African labour force.

The Gold Coast Government is giving assistance to one company to carry out development in a promising area; the terms of the proposed loan include a levy of 5s. per ton on the treatment of payable ore from the specified area and a lien on the company's housing.

Two companies are milling a grade of ore yielding over 20 dwt. of gold per ton.

Diamonds

The market demand for both gem and industrial stones was well maintained throughout 1953 though towards the end of the year the demand for industrials lessened somewhat, a position which it is thought may continue.

Consolidated African Selection Trust Limited, the principal producer of Gold Coast diamonds, in their report for the year to June 30, 1953, stated that their production amounted to about the same caratage as in the previous year but that they had to treat a far greater yardage for it, which resulted in considerably higher working costs. The price obtained for their stones, however, showed an improvement, so that the net out-turn at £951,000 was slightly higher than for the previous year. Taxation at £713,000 reduced the profit to approximately £238,000; after allocating £150,000 to the reserves for replacements and extensions of fixed assets and for prospecting and development the surplus available for distribution from the company's Gold Coast operations amounted to only £90,000.

A study of these figures illustrates clearly how the present system of taxation directly penalizes efficient operations, since a reduction in costs results in a still more crushing rate of minerals duty.

Manganese

Production of manganese ore in the Gold Coast during 1953 was maintained at approximately the same level as that of 1952 (794,192 tons), and represented about one-quarter of the world's total production measured in terms of the manganese content of metallurgical ore ranging from 45 to 47 per cent. The principal consumers of Gold Coast ore are, as has been the case for some years past, the steel industries of the United States, the United Kingdom and Norway. In addition to the metallurgical ore, a high percentage of the ore produced is peroxide ore used in the manufacture of batteries and in certain chemical processes Except for a very small tonnage, the whole of the output came from the deposits at Nsuta, in the Tarkwa district, which are the property of the African Manganese Company. The company employs about 50 Europeans and between 4,000 and 5,000 African workers.

Bauxite and the Supply of Hydro-Electric Power

The reserves of bauxite in the Gold Coast are currently estimated at 225,000,000 tons. Exports in 1953 amounted to 115,075 tons valued at £201,383.

Three ministers of the Gold Coast Government recently visited Canada to study the Canadian aluminium industry; they visited certain hydro-electric plants and smelters in eastern Canada and discussed with officials of Aluminium Limited the plans of the proposed Volta River scheme in the Gold Coast. It is intended that the governments of the United Kingdom and the Gold Coast should bear the cost of erecting the dam, whilst British and Canadian aluminium companies will pay for the smelter.

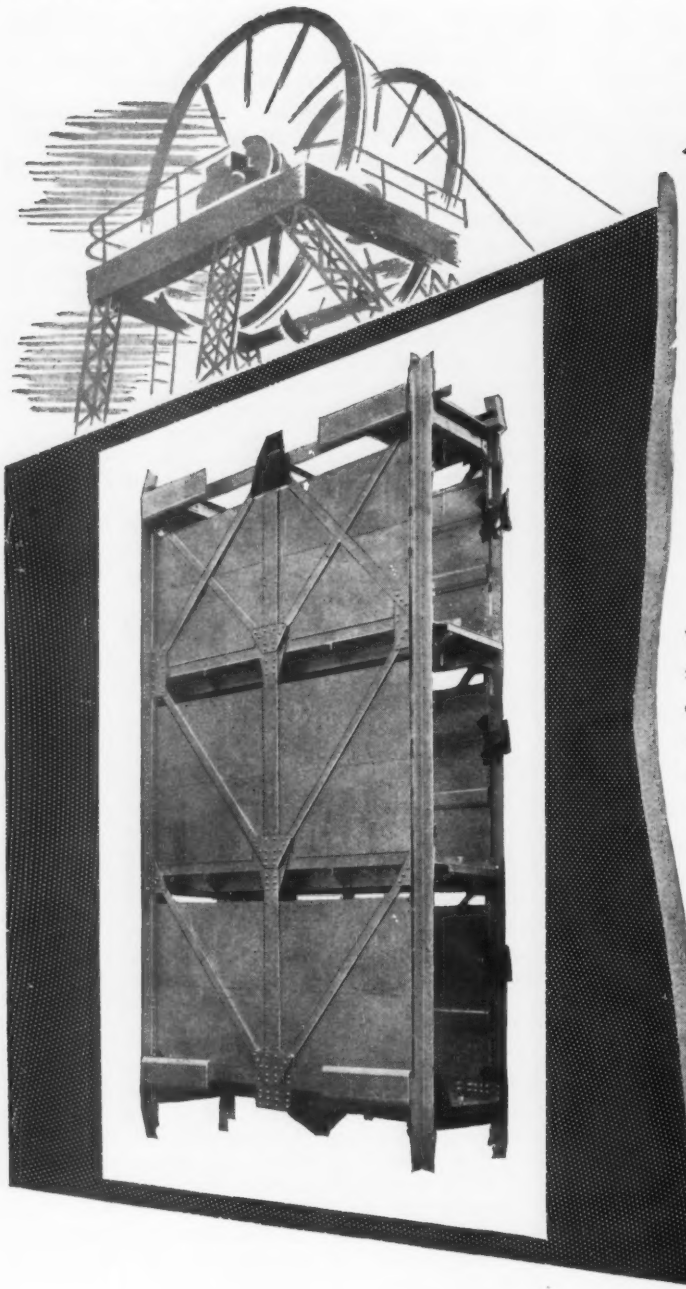
It is expected that the preparatory commission which is investigating the Volta River project will, barring unforeseen delays, report on its technical and economic advisability before the end of 1954.

NIGERIA

Political conditions in Nigeria have been difficult throughout the year under review. It is, however, hoped that the recent conference between the Secretary of State for the Colonies and representatives of the various political parties will go a good way towards stabilizing the situation and make for smoother working of the government.

Despite a declared policy of encouraging some degree of industrialization and of increasing the participation of Nigerians in some of its less highly technical industries, Nigeria's economy to-day still remains based on its agricultural and mineral wealth. Of the latter, tin continues to be pre-eminent, despite last year's substantial fall in price. Fortunately for some tin mining companies, any reduction of profits from tin may well be off-set by increased production of columbite, for which the United States government is at present paying over £2,000 per ton of 65 per cent concentrates.

The principal mineral exports for the year are shown in the table. Their value totalled £10,798,343 compared with £9,059,576 in 1952. In addition the production of gold in 1953 amounted to 861 f.oz valued at £8,541 as compared with 1,349 f.oz. valued at £14,458 for the previous year. Coal production amounted to 700,264 tons as compared with 582,858 tons valued at £972,502 in 1952. Royalties paid to the Nigerian Government on mineral exports in 1953 amounted to £1,568,939 as compared with £1,353,811



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in 1952. The labour force employed in the industry totalled 64,990, a decrease of 5,145 over the previous year. Considerable attention is being given to the welfare of employees, relations with whom remain satisfactory.

Broadly speaking, Nigerian tin and columbite producers achieved better results in 1953 than in the previous year, particularly in the case of columbite, which showed a big improvement. Whilst the average price per ton of tin showed a considerable decline as compared with 1952, the average price obtained for columbite was much higher. All producers are, therefore, stepping up their production of columbite as much as possible.

Tin

Total world production of tin in 1953 amounted to approximately 178,000 tons, of which Nigeria produced 5.4 per cent. There are at present 17 companies mining tin in Nigeria ; seven of these are also producing columbite.

Production costs during 1953 increased by approximately ten per cent, chiefly owing to the continued rise in the cost of stores and African labour. Some of the areas worked solely for tin incurred losses owing to the rapid fall in the price of tin and to the Nigerian government's insistence on a certain minimum amount of work being carried out on all leases. On one property where the lack of a good water supply had held up its expansion, it is proposed to soften up the ground by the use of explosives in order to effect dry stripping operations ; this would increase output and reduce costs.

It is clear that the grade of available tin-bearing ground is declining as well as becoming more difficult and costly to work, a state of affairs which applies, of course, to other tin producing countries besides Nigeria. Continuous and large-scale prospecting is, therefore, needed in order to find fresh areas, as also is a steady price for the commodity. Working costs are now three or four times pre-war.

Columbite

The United States government is still making every endeavour to encourage the expansion of the production of columbite. The 100 per cent bonus on the price which has been offered by that government until 1956, or until their stockpile is completed, is acting as a great stimulant to production and to efforts to find fresh sources of supply.

Largely as a result of this incentive bonus purchase programme, imports of columbite-tantalite concentrates into the United States last year showed a big increase. Over 99 per cent of the total U.S. supply in 1953 was imported, largely from Nigeria. It is estimated that the United States stockpile requirements have by no means been fulfilled, and that even when the present bonus price is dropped the demand should expand from other countries which need the mineral but cannot afford it at present-day prices.

With only one exception, every producer of columbite in Nigeria reports an improvement in output over the previous year. One of the largest producers has signed a contract with the United States Government for an advance of £250,000 to finance development and equipment of their areas in the Liruei-n-Kano district The company is required to spend £100,000 on these areas in step with advances made by the government. The indicated ore reserves on this company's leases in the Liruei and Rishi districts total 1,025 s.tons. In the last-named district the company now holds mining leases covering over 1,500 acres, together with exclusive prospecting licences over a further three square miles. The United States Government have agreed to advance up to £100,000 for the development of these areas. A contract has also been signed for deliveries up to June, 1955, at £2,180 per s.ton containing 73 per cent grade, and at £2,107 per s.ton for deliveries between July, 1955, and December, 1956. It is estimated that deliveries under this contract will have a value well in excess of £1,000,000 and will materially increase the profits of the company. By 1955 this company's revenue and profits from columbite will considerably exceed those derived from tin.

Considerable quantities of columbite ore have recently been found in the biotite granite of the Nigerian plateau, and Keffi Tin Co. Ltd., a wholly owned subsidiary of Amalgamated Tin Mines of Nigeria Ltd. (the world's largest producer of columbite) is now working the deposits and has already commenced production. The proved reserves of the mineral, which can be economically mined at the current price, are estimated at about 15,000 tons. There are still other areas of similar country to be prospected and it is anticipated that these reserves will be substantially increased.

Lead/Zinc

Fresh work is shortly to be undertaken on the lead-zinc deposits in Southern Nigeria recently investigated by the American Smelting and Refining Company, who released their option on the properties after having spent $1,770,000 on their examination. The company's decision to abandon operations was, however, taken when the mines became flooded and there was neither equipment nor power available to cope with the flooding. It is expected that underground development will be undertaken from existing shafts commencing at the Ameri Lode. The object of the programme will be to prove part of the higher grade ore reserves already indicated by diamond drilling.

SIERRA LEONE

Mining has an important bearing on the prosperity of Sierra Leone, the value of minerals exported representing approximately 30 per cent of its total exports. The production of diamonds and high grade haematite ore continues to be satisfactory, while the output of chrome ore is exceeding all previous records.

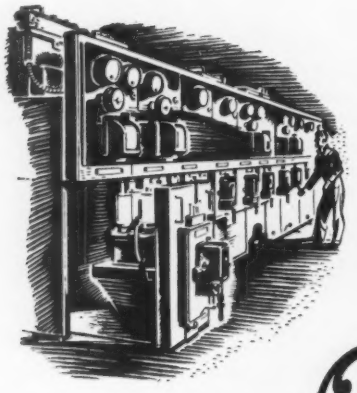
Exports of the principal minerals in 1953 are shown in the table on page 133 ; their value amounted to £4,358,265.

Diamonds

The production of diamonds during the year suffered very seriously owing to illicit mining and theft, which are still rampant in the Colony, and it is estimated that as a result of these activities sales of diamonds were reduced by about £430,000. This is obviously a matter of very serious concern, not only to the producing company but also to the governments of Sierra Leone and the United Kingdom. The Sierra Leone Government is accordingly collaborating with the company in their efforts to deal with this problem, with, it is understood, a certain measure of success. The profits of the sole producing company (Consolidated African Selection Trust Ltd.) from the sale of diamonds for the year to June 30, 1953, amounted to £1,338,000, of which £611,000 was paid in taxes to the two governments. Active prospecting added new areas to the mining reserves and has offset to a considerable extent reductions resulting from mining operations.

The Sierra Leone Government recently requested the operating company to enter into negotiations with them for a revision of the terms of the Exclusive Licence Agreement under which the company is now working ; this revision has been carried on in a most friendly and co-operative spirit and complete agreement reached.

In a speech in the Sierra Leone Legislative Council the Minister for Lands, Mines and Labour, Mr. Siaka Stevens, stated that there are possibilities of more minerals being discovered and that the Colony should do everything to further their exploitation and take positive steps to encourage not only those who have already invested their capital in the country but any other people who may want to come from outside and do likewise.



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The United States

By LEROY A. PALMER

THERE has been much talk in this country and abroad of a "recession," polite name for a depression, in the United States during 1954. Undoubtedly there are some who would like to see this happen as a matter of political capital.

When the present administration took office the country had been for years in a period of steadily increasing inflation and efforts made to check it were of little effect during the first year due to acquired momentum. Furthermore, 1953 was a boom year and it can hardly be expected that subsequent years will maintain the same level. Mr. Eisenhower has surrounded himself with a group of advisers of outstanding business experience, in fact the criticism has been made that they are too representative of "big business" rather than of the people as a whole. These men have given serious thought to the impending problem and to devising means to combat it should it materialize. Aside from the ultra optimists and the alarmists, the cautious but representative view is that there will be a period of readjustment following the unusually high production of recent years and that it will pass into a stable business cycle on a somewhat lower level without panic or prolonged depression.

Much depends on the attitude of Congress toward the Administration's measures and the promptitude with which it takes action.

The Randall Report*

As one step toward re-establishing a sound economy for the country the President, at the behest of Congress, appointed a "Commission on Foreign Economic Policy," popularly known as the Randall Commission from its chairman, Mr. Clarence B. Randall. The commission's instructions were "to examine, study and report on the subject of international trade and its enlargement *consistent with a sound domestic economy.*" (Your correspondent's italics.) The commission consisted of five members from each House of Congress and seven from industry, commerce and academic life.

The report, which was submitted early in 1954, has been subjected to considerable criticism because of its inconclusive nature, apparently overlooking the fact that the commission was a purely advisory body, without administrative or legislative authority. Throughout, the opinion is expressed that the United States cannot achieve many of the desired ends by individual action and that multilateral agreements reached by negotiation with the interested countries are necessary.

Some of the salient recommendations are :

Aid—Economic aid on a grant basis should be terminated as soon as possible. It specifies that "economic aid" does not embrace technical assistance (Point IV), which it commends.

Foreign investment—There should be greater participation in foreign investments and to encourage this there should be clarification of anti-trust laws, modification of income taxes on foreign investments, guarantees against expropriation and inconvertibility of currencies. This policy is also emphasized in the section dealing with dependence on imports.

Tariffs—The "Buy American" Act, a depression measure of the 'thirties, should be modified to allow the President to make exceptions when advisable. The Tariff Commission should make a complete study of the whole subject and, based thereon, the President should be empowered to make such changes in rates as he may see fit. Power to negotiate trade agreements should be extended not less than three years and multilateral negotiations undertaken towards a gradual reduction of tariffs. If advisable the President should be authorized to make reductions without demanding reciprocal concessions. Escape clause and peril point should be retained but again the President should be given discretion. (In practice there has been very little actual application of these.) The trend of these tariff recommendations "implies . . . gradual and carefully considered step by step action." Subsidies in lieu of tariff increases were not discussed, being a domestic matter.

East-West trade—With respect to East-West trade the United States should acquiese in more trade in peaceful goods between Western Europe and the Soviet *bloc*, subject to the embargo against Communist China and North Korea.

Convertibility—On currency the report does not favour a "dash for convertibility" but advises "gradual and prudent steps in that direction." This policy concurs with that of the majority of English banks as set forth in *The Mining Journal* of January 29, 1954. Recognizing that sterling is a "key" currency it is desirable that it should be convertible but to accomplish this Great Britain's reserves should be strengthened "for the purpose of a gradual and controlled approach to full convertibility." Adequate reserves could be found through a much more active utilization of the International Monetary Fund and the Federal Reserve System should explore with foreign central banks the possibility of standby credits or line of credit arrangements.

Mid-Century Conference on Resources for the Future

A meeting of this conference, which is sponsored and financed by the Ford Foundation, was held in December. The official report is not expected until late summer but some previews have been made available. The purpose of the meeting was "research and education in the field of resources development and conservation" and it made no attempt at predicting conditions 25 years hence as did the Paley Report of two years ago.

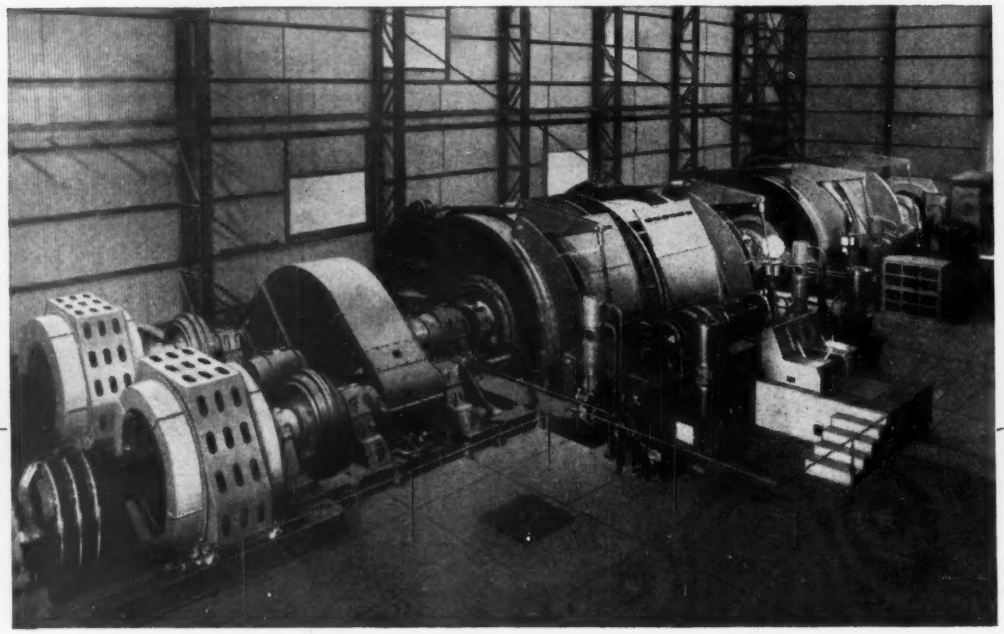
With respect to the problems of non-fuel minerals the report is encouraging to the mining industry. It was agreed that the present $75,000 limit on exploration should be removed and that revenues from an orebody should not be subject to taxation until investment capital had been recovered. Research should not be left to any one section of the mining interest but be carried on simultaneously by government, industry and universities. Basic mining laws permitting acquisition of title to mineral lands by individuals or corporations should be retained. Several suggestions were considered to aid industries suffering from depressed prices including tariff, straight or differential, import quotas, subsidy and government purchase.

Production

Mineral production in the United States during 1953 was the greatest in history. Preliminary reports by the Bureau

* [Since this article was written by our U.S. correspondent, several policy statements on stockpiling and foreign trade policy have been issued from the White House and the President's own Minerals Policy Committee has submitted its report. By and large it appears that the foreign trade policy legislation which the President will invite Congress to adopt will be in line with the recommendations of the Randall Commission.—Ed., *M.J.*]

Twin A.C. hoists in South Africa



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of Mines estimate a total value of $14,346,000,000, exceeding 1952 by 7 per cent. Fuels made up 71 per cent of the totals and petroleum and natural gas made up 70 per cent of the fuels. Thus the latter two account for 50 per cent of the total mineral production. Value of non-metallic minerals increased 8 per cent and of metallic 11 per cent.

The table on this page, showing mine production except for aluminium, is based on data considered reliable but not always complete at this writing. They may be viewed as accurate within close limits. Some variation from figures submitted for previous years is due to more complete data available since the latter were published.

Silver-Gold

Production of precious metals, with the exception of silver, increased over 1952. The latter, almost wholly a by-product, suffered from the depressed condition of the lead-zinc industry, declines being recorded by all the silver States except Montana.

Fixed price and continued inflationary costs still retard the recovery of gold mining but some greater activity in straight gold mines tended to offset decline in byproduct gold with a resultant increase of 2 per cent over 1952 to 1,924,000 f.oz.

MINERAL PRODUCTION

	1951	1952	1953
Gold .....000,000 f.oz.	1.98	1.89	1.92
Silver .....000,000 f.oz.	39.46	39.10	36.77
Copper .....000 s.tons	928.33	924.47	926.00
Lead .....000 s.tons	338.16	390.16	335.41
Zinc .....000 s.tons	681.19	666.00	534.13
Aluminum .....000 s.tons	836.88	937.88	1,246.00
Molybdenum ...000 s.tons*	19.43	21.63	28.70
Tungsten .....000 s tons*	2.96	3.62	4.47
Chromite .....000 s.tons	7.06	21.30	57.50
Manganese .....000 s.tons†	95.20	116.30	161.00
Mercury .....000 flasks‡	7.29	12.56	14.30

* Metal content.
† Ore containing + 35% manganese.
‡ Flasks of 76 lb.

Copper

After decontrol on February 25 copper prices were confused but finally stabilized at 29.5 to 30 c. with an average for the year of 28.8 c. Despite this advance over the controlled price of 24.5 c. the anticipated increase in production did not materialize and the Korean truce caused a slackening from the expected demand during the second half of the year.

Lead-Zinc

Lead and zinc presented an anomalous situation in that with consumption high, a record high for zinc, the mining industry was severely depressed due to large imports at prices that made operation of many domestic mines unprofitable so that many closed down or curtailed production.

Lead opened the year at 14.7 c., reached a low of 12 c. in April, then, after some fluctuation, stabilized at 13.5 c. which worked out as the average price for the year.

With the exception of one very brief and slight recovery the price of zinc declined steadily during the year from 13 c. on January 1 to 10 c. in September, which latter price held for the remainder of the year.

While it is recognized that the United States is no longer self sufficient in these two metals, imports were far in excess of the amount necessary to make up the difference between consumption and mine potential under normal conditions. The current condition of the industry has brought agitation for relief in one form or another and three different government committees have been studying the situation. Various remedies have been suggested including straight tariff increase, differential tariff, subsidies, stockpile and buffer stocks.

The greater part of the lead and zinc output is recovered from ores that contain both metals so that what affects one affects the other. There has been much discussion in connection with the tariffs as to what total price for the two metals is essential to successful operation. At a recent hearing before the Tariff Commission representatives of the National Lead and Zinc Committee reached a figure of 31 c. as necessary for a "heathy" industry and stated this would not be sufficient for a marginal mine unless its ores carried a substantial silver content.

Notwithstanding the unfavourable position of the metals and the closing down of many of the mines, operators are not taking a pessimistic view in the long term. The idle mines are maintained on a standby basis and active exploration and development are being carried on.

Iron and Alloy Metals

Aided by improved carrier facilities from the mines of the Great Lakes to the steel mills, iron ore production reached an all time high of 117,000,000 l.tons—20 per cent higher than in 1952.

Molybdenum—With a production of 28,700 tons of metal content of concentrates, molybdenum output exceeded 1952 by 33 per cent. This was only a little lower than the banner year of 1943 and, because of increased output from Climax, production in the second half of last year exceeded that of the corresponding 1943 period. Climax is by far the largest producer with most of the remainder a byproduct from the porphyry copper mines, whose ores carry less than .5 per cent molybdenum. With recent development and plant capacity enlarged to 27,000 tons Climax is now next to the largest underground operation in the world.

Tungsten—Tungsten had a good year with consumption and production practically in balance. High incentive prices stimulated output and many small mines that had been under development were brought into production during the year.

Chromite—Improved facilities for marketing chrome ores and the entrance of the Mouatt mine as a producer caused a decided increase in chromite production to 57,500 tons as compared with 21,300 tons in 1952, a 170 per cent increase. Mouatt is operating a low-grade deposit in Montana and entered the market in August with a 1,000 ton mill operating at half capacity at the outset. Product is a concentrate of 38 per cent Cr_2O_3 from an approximately 20 per cent ore.

Manganese—Again a stimulating purchase programme had its effect, and output of 35 per cent or better manganese ore reached 161,000 s.tons, 40 per cent more than in 1952. One of the principal producers, Manganese Ore Co., was out of the market for six months because of a disastrous fire.

Nickel—If plans of the Hanna Nickel Smelting Co., now well under way, are carried out the United States will become a producer of nickel on a commercial scale for the first time. Hanna Nickel, a subsidiary of M. A. Hanna and Co., has acquired a large deposit of garnierite, reported to carry 1.5 per cent nickel, in southern Oregon. Total cost of development is estimated at $35,000,000, of which $24,800,000 is on loan from D.M.P.A. for smelter construction. The company agrees to furnish the government with 95,000,000 to 125,000,000 lb. of nickel in ferro-nickel of not less than 25 per cent nickel content. Four electric furnaces with an annual capacity of 7,000 to 9,000 tons of nickel are planned to be in operation by the end of the year.

Cobalt—Production of cobalt is estimated at 1,315 tons of metal, up one-third from 1952. About one-half of this was from concentrates from domestic ores with the remainder as smelter by-product. Calera Mining Co. (Howe Sound) commenced production during May using the Chemico process at its Garfield, Utah, refinery, but was hampered from the start by mechanical difficulties and

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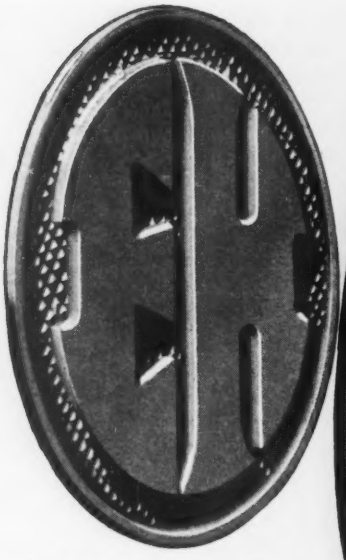

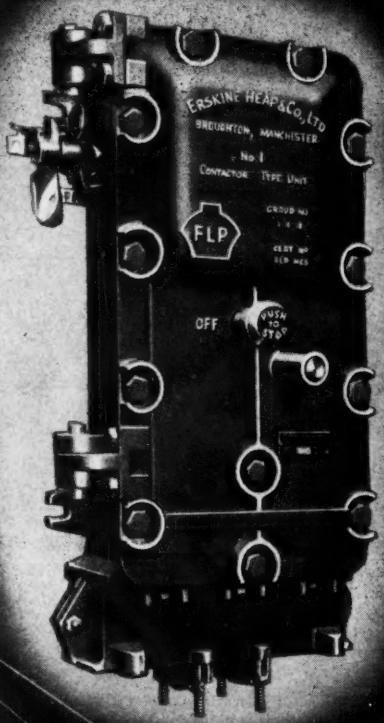

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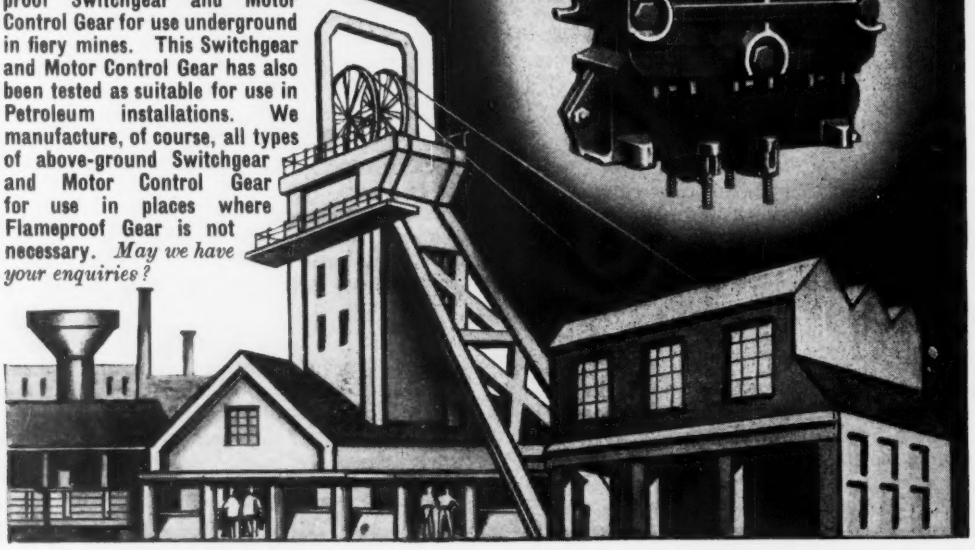

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666 A

never attained rated production. Calera has entered into an agreement with Chemico by which the latter agrees to spend $1,000,000 on a "no cure, no pay" basis to bring the Garfield plant up to rated capacity within two years. National Lead Co., also using the Chemico process, expects to have a plant for extraction of copper, nickel and cobalt in operation during 1954.

Titanium

Titanium production is estimated at 2,300 s.tons, more than twice that of 1952, but greatly increased military demands prompted the government to reimpose controls on civilian consumption and set a production goal of 25,000 tons of titanium sponge per year. Of this amount contracts have been made for an annual output of 13,200 tons per annum over a five year period. The stage of development of titanium metallurgy is such that just now there is some hesitation to invest for fear that a plant designed now might be outmoded by the time it was built.

Aluminium

With a 1953 production of 1,246,000 s.tons, one-third more than in 1952, aluminium set another record high. Production has doubled since 1948, 90 per cent of the increase coming after the outbreak of the Korean War, and due to enlarged plant capacity. By far the greater part of the ore is imported but domestic mines supplied 1,525,000 l.tons of bauxite, 96 per cent of which came from Arkansas. Developments are under way to use the lateritic ores of Oregon for their alumina content.

Mercury

The mercury market has been unstable for many years past, due to the threat of foreign competition, and producers have been slow to respond to favourable prices for fear that they would be only temporary. Such a price recovery in 1951 stimulated the market somewhat and although it was followed by a recession in price its effect carried into 1953 when output was 14,300 flasks (76 lb.), 14 per cent more than in 1952.

Uranium

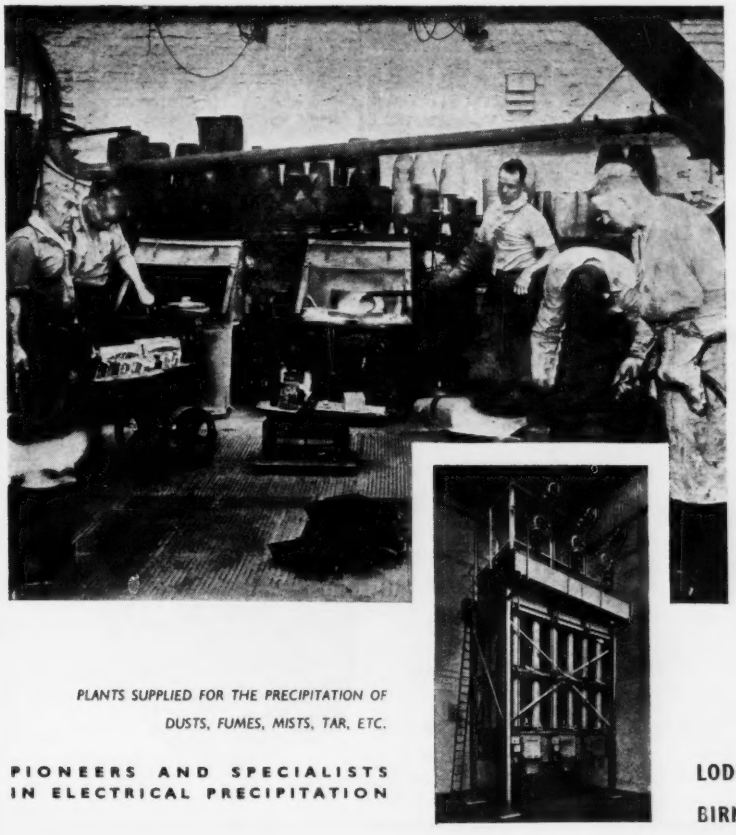
Nothing definite can be said about uranium production as figures are closely guarded. Furthermore developments have been occurring so rapidly that anything submitted at this writing might well be entirely out of line by the time it appears in print. The Atomic Energy Commission has offered substantial prices for uranium ores and concentrates, liberal bonuses for new production and has been generous in the financing of mines and treatment plants. These have stimulated prospecting which, during the past year, resulted in an unusual number of new discoveries and the extension of fields previously demonstrated.

These exploitations have brought out some interesting facts. There is hardly a State outside of the alluvial Great Central Plain area in which discoveries, not necessarily all commercial, have not been made. The number of uranium ores amenable to commercial exploitation has been increased, the ores are found in almost every type of deposit and in geologic horizons from Permian to Miocene, but mostly in the Mesozoic.

Exploration has been by churn and diamond drilling following geophysical tests and 1953 saw a great advance in geochemical and geobotanical methods.

The greater range of ore to be treated made it necessary to develop and adapt new metallurgical methods. Some of the mills in use have been modified quite materially although each uses a leaching process for the production of uranium oxide.

Greatest development is in the Colorado Plateau region where reserves now total millions of tons. Uranium has aroused the interest of capital and is now big business.



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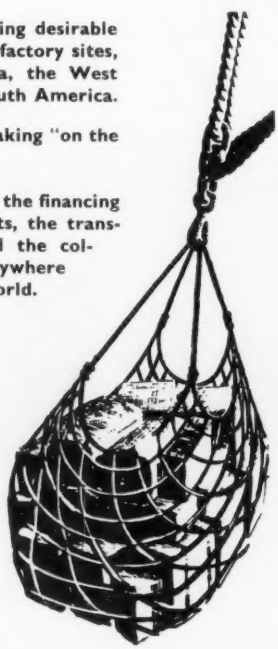

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Canada

By Our Own Correspondent

MINERAL production in Canada rose to a new peak during 1953. This was accomplished despite the adversity of declining prices for base metals, as well as a prolonged labour strike at some of the country's leading gold mines. Preliminary estimates show total mineral output for the year was $1,332,000,000 (without taking into account the value of uranium production), compared with the record of $1,285,000,000 established in 1952.

Production of Principal Metals

Despite increased production of both lead and zinc, falling prices resulted in declines respectively of $3,000,000 and $34,000,000 in output value. The year end found a trend toward lower production schedules in zinc.

Nickel output reached 144,000 s.tons valued at $161,000,000, far exceeding all past records. The year 1954 commenced with promise of further substantial growth. Assisting the expansion of nickel mining is the assurance of long range sales contracts, and the increasing number of uses for the metal.

Copper output remained steady, amounting to 251,500 s.tons valued at $151,000,000. A moderate decline in the price of copper is not expected to slow down production, having in mind that a large percentage of copper is mined in Canada in association with nickel and gold.

Gold production declined to $140,000,000, a level which is expected to be maintained in 1954. The labour situation has undergone marked improvement.

Iron mining continues to grow. Output during 1953 rose by some 25 per cent to 6,500,000 tons valued at $43,000,000. Further increase is taking place, particularly at Steep Rock and Michipicoten in Ontario. Added to this is the development progress in northern Quebec and Labrador. Construction of the new railway of 360 miles from tidewater to the mines is receiving the finishing touches, with the last of the rails having been laid in early February, 1954. Development of 15,000 hydro-electric h.p. will provide the initial motive power. The first shipments of iron ore will begin in late summer.

The development of uranium deposits in the province of Saskatchewan was impressive during the year, but with security regulations preventing the presentation of details. However, the development and construction, which is clearly visible there, is evidence of the important place the field is to hold in the world of uranium mining. Also, the multiplicity of uranium deposits being brought to light in the Blind River and Sudbury districts of Ontario has aroused growing interest. These discoveries are of medium to low grade and in deposits of moderate width, but the frequency of their occurrences offers promise.

Petroleum production during 1953 increased by over 30 per cent and is valued at $198,000,000. Toward the end of the year crude petroleum was flowing through a pipeline all the way from Alberta to the refinery of Imperial Oil Co. in Sarnia, Ontario.

METAL AND MINERAL PRODUCTION

		1951	1952	1953
		(000's)	(000's)	**(000's)**
Antimony	lb.	1,200	2,500	**1,530**
Asbestos	tons	967	966	**912**
Arsenious Oxide	lb.	2,404	1,530	**1,424**
Barite	tons	98	119	**249**
Bismuth	lb.	234	180	**99**
Cadmium	lb.	1,211	1,005	**1,316**
Coal	tons	18,750	17,360	**15,760**
Cobalt	lb.	947	1,303	**1,754**
Copper	s.tons	270	258	**252**
Fluorspar	tons	74	83	**90**
Gold	f.oz.	4,329	4,420	**4,061**
Gypsum	tons	—	—	**3,766**
Iron Ore	tons	4,736	5,205	**6,501**
Lead	s.tons	152	165	**197**
Mica	lb.	4,962	1,991	**1,857**
Molybdenite (MoS_2)	lb.	350	498	**152**
Nickel	s.tons	137	140	**144**
Palladium, rhodium, iridium, etc.	f.oz	162	150	**161**
Petrol	bbl.	48,097	60,864	**81,311**
Platinum	f.oz.	155	120	**134**
Selenium	lb.	369	266	**356**
Silver	f.oz.	24,245	24,376	**30,145**
Sulphur	tons	372	441	**334**
Tellurium	lb.	68	14	**16**
Tin	lb.	364	212	**656**
Titanium Dioxide	tons	14	42	**5**
Tungsten (WO_3)	lb.	20	1,222	**2,384**
Zinc	s.tons	334	382	**399**

Major developments of 1953

Among the interesting developments of the year were :

(1) Brunswick Mining and Smelting Co. indicated more than 50,000,000 tons of ore between surface and a depth of 1,000 ft. The ore contains lead, zinc, copper and silver, the combined metals being sufficient to classify the ore-bodies as medium to high grade, and with widths ranging up to more than 200 ft. This deposit now occupies a place among the major discoveries ever made in Canada, and will add greatly to the industrial strength of New Brunswick.

(2) Geco Mines discovered an important orebody in the Manitouwadge area of Northern Ontario late in 1953. The ore contains copper, zinc and silver with the initial exploration showing widths of as much as 90 ft. One of the initial diamond drill cores carried 4.84 per cent copper, 2.89 per cent zinc, and 3.23 oz. silver per ton across 96 ft. true width.

(3) A decision was made to arrange for the construction of a pipeline of some 2,500 miles in length from the areas of natural gas production in Alberta to the industrial centres of eastern Canada, including Toronto and Montreal. The size of the line will be either 30 or 36 in.

Process of the Provinces

The picture presented by Canada at the beginning of 1954 is decidedly impressive. It offers a broad and impelling panorama extending some 3,000 miles from coast to coast with every province represented. Lying near the Atlantic on the east are the major developments involving the base metal discoveries in New Brunswick, and the vast iron ranges of Labrador. Next, in Gaspe and other sections of Quebec, several major base metal mines are being developed in preparation for large production, while the asbestos producing areas of the province continue to yield some 75 per cent of the world's asbestos.

Meanwhile in Ontario, which province already mines 34 per cent of the minerals produced by all Canada, the nickel industry of the province is expanding at a greater rate than ever before. Also the iron mines in the Sault Ste. Marie and the Steep Rock areas of Ontario are in process of laying out some further $50,000,000 on expansion. Added to this is the multiplicity of uranium discoveries within the province. Next to the west is the province of Manitoba where a new nickel mine of importance has commenced to produce at Lynn Lake. Next to the west is Saskatchewan where uranium deposits of world importance are either in production or making ready to produce. Farther west in the province of Alberta the development of petroleum and natural gas has elevated that province to third place among the mineral producing provinces of Canada. Finally comes British Columbia on the Pacific seaboard where the operations of Con. Mining and Smelting Company and the aluminium works stand out as projects of magnitude—and with new mineral discoveries pointing toward another momentous year.

It is hardly surprising that the Canadian dollar has entered 1954 as the world's most highly valued currency.

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Mexico

By Our Own Correspondent

MEXICO'S ailing mining industry requires capital — national and foreign — rather than credit to assure the exploration and development of her mineral reserves. The Chamber of Mines states, in a pessimistic report, that the industry has been hard hit by declining metal prices in the international market. At the present moment the industry is just barely holding its head above water in the hope that the metals market may take an upward turn.

Government and representatives of the industry have been holding a series of meetings in an endeavour to promulgate "emergency measures" to assist Mexican miners during the current crisis.

Spokesmen for the national mining organization have worked out a seven-point programme they insist is essential if mining activity is not to collapse entirely. The programme includes the following points:

(1) Exemption from all forms of federal, state and municipal taxation. (This is not intended as a permanent measure.)

(2) Expansion of highway and railroad construction to facilitate transportation of mine products and reduce operational costs.

(3) Development of an electrification programme to provide power needed for development and exploration, and reduce production costs.

(4) Creation of a "favourable investment climate" to attract new investors, with moneys to be used for exploration and development of known reserves.

(5) A complete study of mining credits.

(6) Government technical assistance to small mine operations.

(7) Promotion of national and foreign mining investment.

OUTPUT OF PRINCIPAL METALS

		1952	1953
Copper	tons	58,464	**60,144**
Lead	tons	246,024	**224,988**
Zinc	tons	227,376	**218,880**
Gold	troy oz.	460,114	**458,808**
Silver	troy oz.	50,400,000	**45,080,000**

(Source: Mexican Secretariat of National Economy.)

While mining is of major importance to the Mexican economy, with 1952 production valued at nearly Ps.3,000,000,000 ($348,900,000), of which taxation took Ps.900,000,000 ($104,670,000), the Chamber declared that the situation of the nation's mining companies is "gradually becoming impossible." During 1953 prices for lead and zinc—representing 55 per cent of the nation's production—fell off sharply and caused a Ps.600,000,000 ($69,780,000) loss to the industry. This situation was further aggravated by rising production costs.

A subsidy of Ps.25,000,000 ($2,910,000) was granted to small miners by the government last year. While this is the first step in moves to strengthen the industry, it is not enough to defer a total collapse in the mining of low-grade ores and in the industry as a whole.

Slump in Mining Earnings

The threat is self-evident from the official figures released by the Bureau of Statistics of the Department of National Economy. These cover a ten month period only, from January to October, 1953, with the Bureau still working on data supplied for the last two months of the year.

Government figures show that Mexico's mining industry suffered a drastic drop in value of production in 1953, as compared with the previous year. From January through October, 1953, total production was valued at Ps.1,178,000,000 ($136,988,900) as compared with Ps.2,258,000,000 ($262,599,400) for the same months in 1952.

Decline in Output

Production of the leading metals is given in the accompanying table. Aside from copper, all show a decline over the 1952 figures, although Mexico still manages to maintain its lead among silver producing countries. Pessimism is general throughout the industry and a report issued recently by the Confederation of National Chambers of Commerce said "it is not difficult to predict that 1954 will be another bad year for the Mexican mining industry."

During the year the U.S. Defense Materials Procurement Agency completed the placing of contracts for 550,000 tons of Mexican manganese. On all these contracts the U.S. Government will pay $19.30 per l.ton for 25 per cent ore f.o.b. El Paso.

While the situation in the iron and steel industries is somewhat better, the various development projects are still at the "talk" stage. The construction of a new steel mill in the State of Durango is under consideration at a cost of over Ps.300,000,000 ($34,890,000) with production estimated at over 300,000 tons annually. This would be sufficient to cover the 40 per cent foreign currency deficit Mexico now has in this industry and result in savings of at least Ps.200,000,000 ($23,260,000) at present expended on imports.

Need to Revitalize the Industry

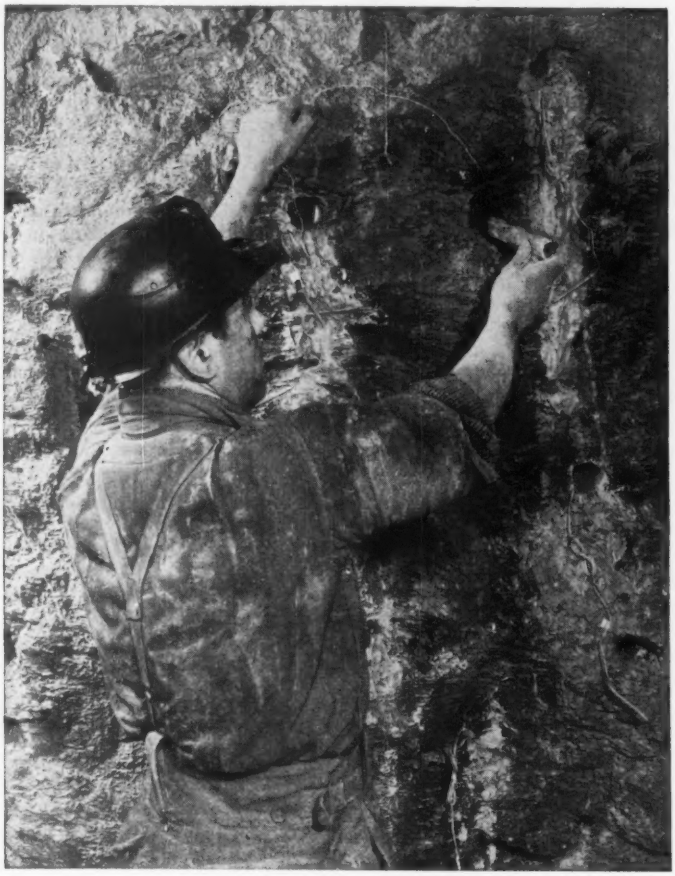
The Mexican Chamber of Mines has pointed out that while the future of the nation's mining industry is indeed black, forthright government action along the lines of the seven-point programme would do much to revitalize the industry.

The Republic's proved reserves of its principal industrial metals are virtually inexhaustible. All that is necessary is action on the part of the government to save the industry from complete failure.

The gravest problem, which has been accentuated during the past year, has been the gradual suspension of mining operations. There are many mining districts in the country which have not been fully explored; there is an "infinity" of abandoned mines, many of them shut down for years. True statistics are not made public by the government on the extent of these "idle" reserves and "marginal mines" put out of business because of high production costs, heavy taxation and lack of roads, and no other reliable source can be approached which can give authentic facts and figures.

With the present reaction in world metal markets, Mexican investors have not been interested in supplying risk capital for the steadily failing mining industry. Mining leaders, alarmed by a situation that gives indications of growing out of hand, are attempting to bring pressure to bear on official circles through the Chamber of Mines. There has been talk of interesting foreign capital.

It is learned on the best of authority that as a result of a U.S. businessmen's visit at least $6,000,000 will be invested in Mexican enterprises, about half of this sum going to the mining industry. A Canadian group, too, showed some interest in mining investments and a willingness to sell much needed mining equipment. But at this writing nothing concrete has as yet come of preliminary talks.



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Caribbean

THE economic future of the British Caribbean territories is likely to be greatly influenced by two events which took place in 1953. The first was the grave crisis which led to the suspension of the Constitution in British Guiana ; the second, the London conference in April at which agreeemnt was reached on the main features of a " British Caribbean Federation."

Political and Economic Problems

The short-term effects of the emergency in British Guiana on the Colony's mining industry were indicated by the news that prospecting operations had been suspended by several companies. Nevertheless, the political disturbances do not seem to have had serious repercussions on the principal mining interests. There is also no evidence that the unrest in British Guiana is spreading to other Caribbean territories. In the long run, the crisis may actually accelerate the tempo of mining expansion. Mr. Oliver Lyttelton, the Colonial Secretary, has given orders to speed development plans for British Guiana—estimated to require at least £15,000,000 in the next five years. Detailed proposals for the first two years, costing some £9,000,000, have been produced. In announcing these plans, however, Mr. Lyttleton made no reference to the mining industry, nor has any practical solution to the financial and administrative difficulties of opening up the interior been produced by the mission sent to the Colony early in 1953 by the International Bank for Reconstruction and Development.

Neither British Guiana nor British Honduras will participate in the proposed " British Caribbean Federation," which is supported by Jamaican leaders despite popular reluctance. Delegates from 12 territories agreed to accept the report of the Standing Closer Association Committee, 1948-49 (the Rance Report) as an " acceptable and workable plan." The next step is examination of the report by the Colonial Legislatures. The U.K. Government will continue assistance to the federated territories on the lines proposed by the Rance Report.

British Guiana

Bauxite remains British Guiana's principal mineral export. In 1952, the Colony produced 2,426,264 tonnes of bauxite and was the second largest producer. Alcan's subsidiary, Demerara Bauxite, was unaffected by the strikes and continues to produce on a great scale. This company has installed new kilns at Mackenzie and is probably the world's largest producer of calcined bauxite. Kennecott Copper was reported to have approached the British Government last year for permission to explore the Pomeroon district as a possible source of bauxite in commercial quantities. Small quantities of pistolitic bauxite have been found near the Blue and Oko Mountains.

The gold output for 1953 at 20,965 oz. showed a decrease of 3,257 oz. compared with the previous year's total. There was also a slight decrease in the diamond output, which fell from 38,304 m. ct. in 1952 to 35,305 m. ct. last year.

British Guiana Consolidated Goldfields Ltd. dredged a total of 2,317,982 cu. yds. in 1953 for a production of 16,025 oz. of gold. Their gold reserves were reported to be satisfactory. The company continued operating with its newly acquired 6 cu. ft. Yuba dredge below the Tumatumari Falls, Potaro River, and dredging was also in progress on the Mahdia River. Negotiations for the purchase of a large secondhand 10½ cu. ft. Yuba dredge from New Guinea to work the Konawaruk River proved successful and the dismantled dredge reached Georgetown in February, 1953. The company decided to instal hydro-electric plant at Tumatumari Falls on the Potaro River to provide power for the dredge on the Potaro and for the 10½ cu. ft. Yuba dredge now being erected on the Konawaruk River.

The Barima Gold Mining Co. (Canada) Ltd. was operating on the Barima River with a single bucket pontoon dredge. The New York-Alaska Dredging Corporation decided to re-investigate the alluvial gold deposits of the Quartzstone area, lower Cuyuni River, with a view to possible future dredging operations. Exploration for workable diamond deposits in the Kurupung River by the Kurupung Placers Co. Ltd. was completed. The company found that workable diamond deposits were not sufficiently extensive to warrant large-scale exploration and it has withdrawn.

In 1952 a detailed examination of alluvial and eluvial deposits of columbite in the Mazaruni area was carried out by the Geological Survey. Last year extensions of these occurrences were found by the Geological Survey and other prospectors in areas to the north-east of the Morabisi area, columbite being located in tributaries of the Puruni River and in the Oko River. Commercial companies have been actively engaged in the exploration and development of the columbite deposits in the Morabisi River and Mazaruni River areas, and it is hoped that separation and transport difficulties can be overcome. In March, 1954, British Guiana Consolidated took over the exclusive permission originally granted to Kennametals (S.A.) Co. to explore for columbite over the 75,000 tract of land enclosing the drainage basin of the Rumong-Rumong in the Mazaruni district.

The African Manganese Company is continuing its examination of the north-west part of the Colony and there seems to be some prospect of development. The manganese ore so far observed is detrital and due to surface enrichment. An exclusive permission to explore for manganese over the area was acquired and the company is examining deposits at Saxacalli in the Essequibo area.

The third Geological Congress—a meeting of official and private geologists from the three Guianas—was held at Georgetown in September, 1953.

Jamaica

Further progress was made in 1953 in the development of Jamaica's extensive bauxite deposits. Shipments of alumina from the Kirkvine Works operated by Alcan's subsidiary, Alumina Jamaica Ltd., started in January, 1953. Expansion of the works capacity from 65,000 tons to more than 160,000 tons of alumina annually is nearing completion. Shipments of alumina to the British Columbia smelters were expected to begin early in 1954. Consignments of Jamaican alumina have been shipped to Norway. During 1953 production was disorganized by a month-long strike of 700 workers of Alumina Jamaica Ltd., which was settled by arbitration. Wage increases of between 4s. and 8s. per day have been granted to bauxite workers employed by Reynolds Jamaica Mines, whose new wage structure ranges from 16s. 3d. per day or 2s. 1d. per hour for unskilled labour to £1 18s. per day or 4s. 9d. per hour for other categories. This is the highest hourly rate in the Jamaican bauxite industry.

Bauxite deposits are reported to have been found by a survey team organized by Reynolds Mines in quantities equal to those of any deposits at present being worked in the territory.

The Kaiser Bauxite Company has temporarily suspended shipments of Jamaican bauxite to Baton Rouge, Louisiana, pending the completion of a major reconstruction and installation programme at Baton Rouge.

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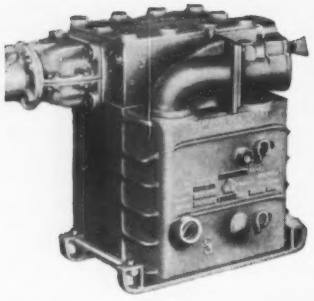

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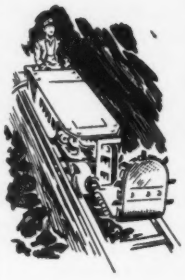
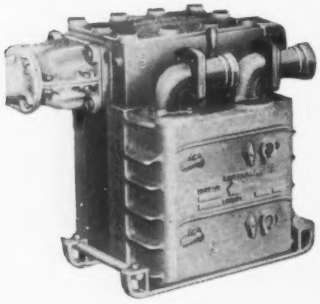
Generously-rated 3-phase contactor, tested to 600 amps. at 0.4 power factor on 100 operations at three seconds' intervals.
Isolator and contactor mechanically and electrically interlocked.
Pilot circuit to latest intrinsically safe requirements.
Three outlets for interlocking and control circuits plugged in power unit assembly.
Instruments fitted if required.
Earth leakage protection and test circuit.
Pluggable type overload assemblies.

Specification P3/1950

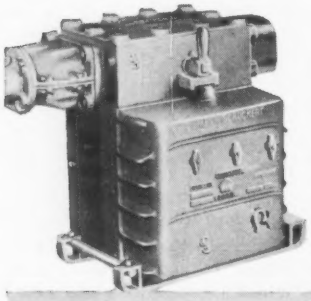




Type BDT.10 Double Unit Drill Panel

Pilot circuit on each of two drill circuits to latest intrinsically safe requirements.
Earth leakage protection independent for each circuit and fitted with indication and test circuits.
Overloads of normal and short circuit capacity fitted as desired by Ministry of Fuel and Power.
Whole control unit pluggable design.

Specification P9/1950



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Three circuit outlets available.

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Raising the cover by the single screw bolt automatically disconnects the supply control circuit, already isolated by the generous-sized 3-phase reversing isolator. The plug-in contacts are, therefore, unable to make or break on load current.

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Dimensions

Overall height	26"
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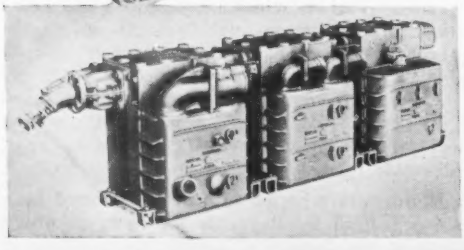

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Brazil *By Our Own Correspondent*

COMPARED with 1952, investments in mining activities increased by £1,812,000 last year to £5,528,000.

The ex-British Itabira mines produced 2,017,355 tons of iron ore, as against 1,794,870 in 1952, but exports dropped 177,078 tons to 1,383,738 owing to decreased sales to U.S.A. when world prices declined. Sales to Europe are increasing and contracts were signed to ship 1,000,000 tons in 1954.

Comparing January to September, 1952 and 1953, production of pig iron increased by 57,331 tonnes last year to 654,447 ; steel ingots by 101,949 to 764,274 tonnes.

Non-Ferrous Metals

Companhia Estanifera do Brasil installed modern plant at Volta Redonda in 1953 and will produce 3,000 tons of metallic tin annually. The plant comprises four specially-built transformers, three electric resistance furnaces and mechanical section for complex ores, consisting of three electro-magnetic separators, vibratory tables and screens, crushers and calcination furnaces.

The new concrete-lined shaft of the Sao Joao del Rei Mining Company has reached a depth of 200 metres and will be continued to 1,100, with a dia. of 7 metres. The work will facilitate exploitation of the principal vein and raise crushing capacity from 1,500 to 3,000 tons daily.

In Goias preliminary work was speeded up, preparatory to exploiting and industrializing the important deposits of nickel ore at Sao José de Tocantins. The ore is associated with cobalt and copper and the reserves are estimated at several millions of tons, with a metallic content of 4 to 5 per cent, which in some cases reaches 16 per cent.

In the Amapa Territory engineers have been examining the recently-discovered cassiterite deposits of the Amapari River and the chromite beds along the Rio Preto. A discovery of cobalt was reported from the Sao Joao del Rei region of Minas Geraes, where the Department of Mineral Production has been prospecting for tin ores. A special survey of the mineral resources of north-east Brazil was begun in 1953.

Coal and Petroleum

Coal production remained stationary at 2,000,000 tonnes, but should now increase. The Five-Year Plan, approved in 1953, allots £19,000,000 to rationalizing the industry, improving rail and sea transportation and building coal-burning power stations near the mines.

The capacity of the government's refinery at Mataripe, Bahia, was raised to 5,000 bbls. daily in 1953. The 45,000 b.p.d. plat at Cubatao will be completed in 1954 and two private refineries, with joint capacity for 32,000 bbls., will start working in 1955/56. Drilling was begun at Nova Olinda, Amazonas, with promising results, and several wells are producing oil in commercial quantities in Bahia.

The Search for New Deposits

In 1953 the Department of Mineral Production (D.N.P.M.) continued measuring iron and manganese reserves in Minas Geraes and zirconium and bauxite reserves in Poços de Caldas. Prospecting of copper and tungsten deposits in Rio Grande do Sul was intensified. Plant was installed to separate and process uranium, tantalum, tin and lithium minerals in Minas Geraes and Orquima of Sao Paulo began producing pure uranium oxide on a commercial scale.

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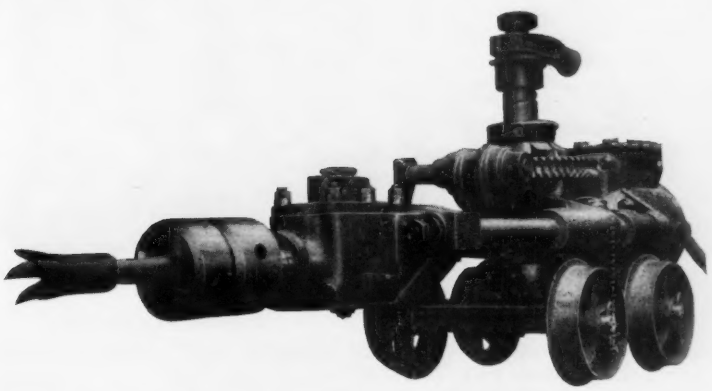

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Agents throughout the World

Peru

THE mining picture in Peru, a country exceptionally favoured with strategic and critical minerals, is, at present, neither black nor white. On the credit side is this nation's liberal Mining Code, promulgated in 1950, which guarantees foreign investments and encourages the development and exploitation of Peru's huge mineral resources. However, on the debit side is the drop in world prices for strategic minerals as well as the tariff protectionist movement in the U.S., particularly on lead and zinc.

U.S. direct mining investments in Peru in 1951 amounted to approximately $10,000,000. By 1952-53 this amount was increased by another $21,445,000. Next in line is France with a mining investment of only about $1,000,000, while Great Britain has even less.

Big Mining Investment from Domestic Sources

Peruvians, who in the past have seemed reluctant to invest in their own country, have in the last few years gained confidence in the present administration of General Manual A. Odria as well as by the fact that foreign capitalists deem local projects good risks. They have demonstrated this by investing their money at home instead of abroad. In 1952-53 national mining companies alone increased their investment by $17,000,000.

This remarkable increase came about, belatedly, as the result of the high prices paid for lead and zinc in 1951 and the first part of 1952. Evidently "misled" by indications from Washington as to the crying need for these strategic minerals as well as talk of big loans being forthcoming, investors and mine operators ploughed their large profits back into the mines. They then got caught short by the drop in prices and the end of the Korean war. The expected loans also have failed to materialize.

Cerro de Pasco's Plans

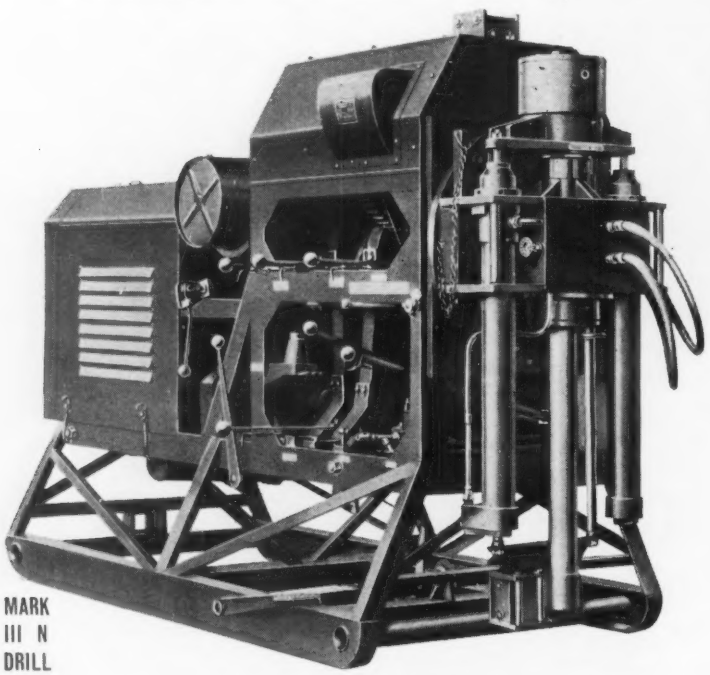
On the other hand investments by U.S. capital in mining are continuing at a high rate this year, particularly those by the large companies who can afford long-range investment or at least the initial outlay required for investigations and explorations. The Cerro de Pasco Corporation is proceeding with the Paucartambo 65,000 kW. hydro-electric project to supply power for its new zinc refinery and other facilities at Oroya in the central Andes. Cerro also plans to invest another $2,000,000 in developing its copper deposits of Cuajone near the southern city of Moquegua.

Activity by Other American Interests

Preliminary work at the rich copper deposits of Toquepala and Quellaveco in southern Peru are being made by the American Smelting and Refining Company which is awaiting a loan of $120,000,000 from the Import-Export Bank. The Northern Peru Mining and Smelting Company plans a zinc refinery at Chilete in the north. The Marcona Mining Company, another U.S. firm, is now exporting some 300,000 tons of iron ore a month. Republic Steel Corp. of Cleveland, Ohio, signed an option last December for exploration development of 30,000 hectares of potential iron ore lands near the Marcona concessions. Exploratory diamond drilling and tunnelling in this area is now being carried out by the Utah Construction Co.

Prospecting for Uranium

Of interest also is that a geological and scientific party from the Raw Materials Division of the U.S. Atomic Energy Commission is now in Peru carrying out investigations in connection with possible uranium deposits. On March 10 a newly created Board of Control of Radioactive Substances was officially installed.



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Chile

THE Chilean copper mining industry was in 1953 faced with the painful effects of the fall in price for the metal and consequently with the revision of taxation of the industry to enable it to face the more competitive conditions.

This fall led to the suspension, for most of the second half of 1953, of copper shipments to the U.S.A. The suspension was accompanied by a reorganization of Chile's administration under which the National Copper Corporation was established to take over from the Central Bank the duties of acquiring, selling and exporting copper.

Chile's Copper Price—

The copper dispute had its beginnings in 1952 when a price policy was arranged on a base price of 35½ U.S. c. for electrolytic f.a.s. Antofagasta. Buyers immediately objected and the Chilean Government thereupon took control of all the output of the three big companies (it had by agreement controlled 20 per cent), imposed a price of 35½ c. and sold the accumulated stock. The U.S. Government then assigned a quota of 60 per cent of its domestic production to consumers, at a fixed price of 24½ c. and Chile was enabled to sell at 35½ c. to give American consumers an averaged-out price of 29.3 U.S. c. per lb.

This procedure lasted till February, 1953, when the U.S. Government abolished its fixed price and quota. Prices then levelled out at 30 c. per lb. and made it impossible for Chile to sell to the United States at 35½ c. Nevertheless, Chile claimed to have sold between February and October, 1953, 105,000 tons out of a current production of 226,096 tons to other countries at 35½ c.

Negotiations proceeded fitfully in the summer while Chile tried desperately to sell the accumulating stocks and even offered copper behind the iron curtain ; a considerable quantity of the small mines' output was sold to Germany.

—and Tax Policies

The negotiations were complicated by the American demand for revision of the tax incidence for the American copper producers which had been agreed in May, 1951, in return for a promise of further investment to raise output to 500,000 tons a year. The taxes levied are : customs duties on imported equipment, a 50 per cent tax on profits, and an indirect tax imposed by the sale of pesos to the companies for their Chilean expenses at the penal rate of 19.37 pesos to the dollar (the bank exchange rate is 110 and the free rate upward of 200 pesos to the dollar), a rate fixed in 1934. In fact, only a sum fixed in 1951 must be exchanged at 19.37 ; the remainder may be exchanged at the fixed bank rate.

It was estimated when Chilean copper was selling at 35½ c. that distribution of the net profit out of the selling price was, in the case of Chuquicamata, 86 per cent to the government, 14 per cent to the company ; in the case of Potrerillos, 96 per cent State, 4 per cent company ; and in the case of El Teniente, 80 per cent State, 20 per cent company. So far, the U.S. Government has only made a special purchase of 100,000 tons at 30 c. for the stockpile and full return to normal trading may be awaiting the enactment of new fiscal legislation.

Progress on the Mines

The big event of 1953 was the official inauguration on April 6 of the new copper sulphide plant at the Chuquicamata mine. Chuquicamata is an opencast mine whose surface oxides, which were lixiviated and transformed directly into electrolytic copper, are approaching exhaustion. The new sulphide plant is capable of treating 60,000 tons of copper a year and will be fed with the richer sulphides now being mined but also, at least for a time, by a stock of sulphides already put aside in the search for oxides and by the sulphide tailings of the lixiviation plant. Milling capacity is being expanded to handle the much greater potential output and, when the oxides are totally exhausted, two more sulphide plants are to be built.

At Potrerillos efforts are being concentrated first on geological surveys, for the present known reserves are becoming exhausted, and secondly on finer milling to increase the extraction rate of the metal.

El Teniente is now operating at the highest production rate in its history. Partly, this increase is due to a higher extraction rate by finer milling, partly the effect of a water pipeline permitting the re-use of water by one of the hydro-electric plants thereby increasing generating capacity.

The future of the small mines is less assured. It was a peculiarity of the government's pricing policy that a premium was put on feeding the lowest grades of ore to the Paipote smelter and, under the influence of high prices, very low grade ores were used and tailings were taken from old mines and dumps. Those small mines which were able, thanks to high prices, to re-equip will be best placed, but others may feel the strain if the price of copper drops below 30 c. per lb.

Chile's copper production in 1953, which was hampered by autumn strikes, declined to about 365,000 s.tons compared with 422,000 s.tons in 1952.

Other Non-Ferrous Metals

Known lead and zinc deposits are too small to be of great significance and the industry has felt the effect of the fall in prices. In the extreme south the future of the mines is closely bound up with a coast road now being built ; in this region the lead grade is becoming lower and the zinc higher as the workings go deeper. After the road is completed it may be that an electrolytic zinc refinery will be built either at Aysen or Huachipato.

Bauxite deposits have recently been identified at Vicuna in Coquimbo Province and a plan has been announced for the erection of an aluminium plant by Industria Manufacterera de Cobre. During the year Cia Minera e Industrial de Bellavista S.A. erected a factory at San Felipe for the manufacture of lithopone from domestic zinc and barium.

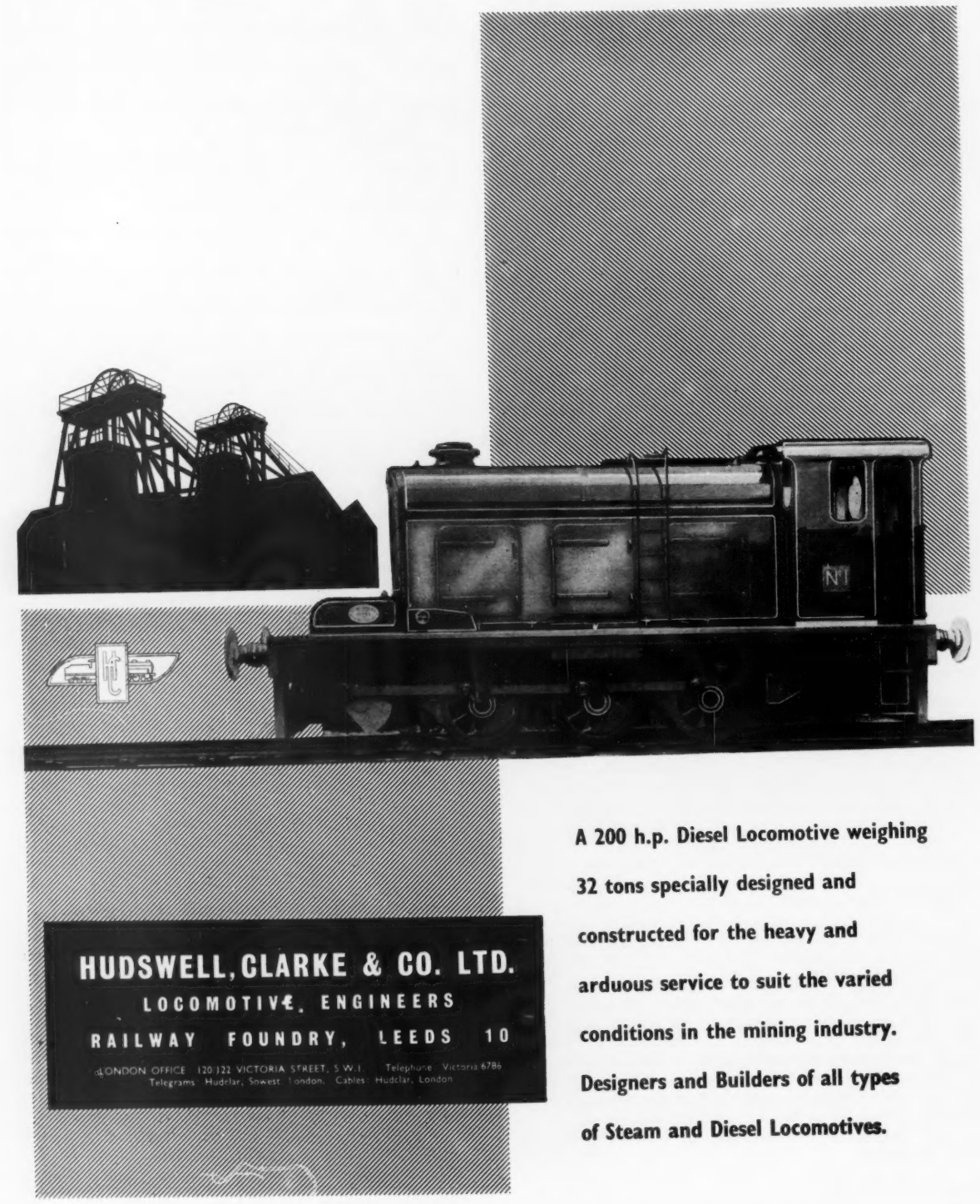
Coal and Oil

It was announced on April 27 that Compañia de Acero del Pacifico had been granted a concession to develop a new coalfield in Aranco province estimated to hold 50,000,000 tons. Chile is one of the few South American countries fairly well supplied with coal—soft, but of good quality.

Empresa Nacional de Petrólcos de Chile has fixed a target of 350,000 cu. metres for 1954 from the Tierra del Fuego oilfields. A new natural gas plant was inaugurated at the end of 1952 and a refinery is due to come on stream in August, 1954. Although the main effort is being made among these fields in the extreme south, Corporacion de Fomento de la Produccion announced its intention in early 1953 of prospecting for oil in north Chile.

Other minerals exploited in small to moderate quantities included manganese, molybdenum, cobalt and mica.

The terms of the Bill to increase foreign investments was announced early in 1954 and they were so phrased as to include the exploitation of minerals within their scope. The prospect of securing new investments, however, is governed largely by the success or failure of the Chilean Government in controlling the chronic inflation.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Bolivia

By Our Own Correspondent

THE threatening outlook which has confronted Bolivia industrially off and on for a considerable period showed no signs of alleviation last year. The Revolutionary Government finds itself unable to avoid the consequences of promises made when seeking to gain power, while it is discovering economic reality to be a different climate to that anticipated.

The Revolutionary Government promised fundamental improvement in the lot of the *Indios* to be effected by the nationalization of the tin mines. They also undertook that the agricultural development of the Altiplano would be taken in hand. However, the initial steps in this direction have backfired, as the new owners of the sub-divided *latifundia* are producing solely for their own need.

Long Term Economic Difficulties

Responsible government officials agree that it will require a generation or more before the main economic difficulties can be overcome. The government has done its best to induce the United States to continue its policy of purchasing Bolivian concentrates to be smelted at the Longhorn smelter in Texas, but after the last purchase of 10,000 tons about November last it seems hardly reasonable to expect that the United States with a supply, including stockpile, reputed to be ample for years ahead, will extend further assistance, and if, as is expected, the government closes down the smelter after mid-summer the *Corporacion Minero* will have to negotiate for the sale of its generally low grade concentrates with other commercial smelters.

While Bolivian officials declare that the known ore deposits now being worked are sufficiently large to promise possible exports of some 32,000 tons of tin per year there is great concern at the low grade—averaging around 30 per cent in tin—which reduces the proceeds from exports owing to the high cost of transportation.

Tin export figures last year were officially given as 35,300 tons as compared with 32,472 tons in 1952. Stocks of tin in Pacific coast ports estimated at around 3,000 tons at the end of 1952, declined about 1,000 tons last year, though the authorities claim that this will not endanger the carrying out of the agreements with the U.S., Great Britain and other countries. Stocks in the mining districts are generally believed to be much lower than two years ago. Production, which over the last decade averaged between 35,000 and 40,000 tons, declined last year to 30,000 tons.

Lack of Experienced Technicians

The expropriation of the Patiño, Hochschild and Aramayo undertakings has resulted in about 90 per cent of the foreign engineers, formerly employed by them, leaving the country. Their place has been taken by Bolivians and some foreigners, including specialists from the United Nations, but the loss of so many experienced engineers with intimate knowledge of the position at the different mines is bound to increase the difficulties of economic working. Krupp engineers have been studying the possibility of establishing an ore smelter in the country.

Aside from tin, Bolivia's principal mineral exports last year included: lead, 23,765 tonnes; wolfram, 2,295 tonnes; antimony, 5,761 tonnes; zinc, 23,971 tonnes; copper, 4,463 tonnes; silver, 190,130 kilos; gold, 32,088 kilos; sulphur, 2,497 tonnes; and bismuth, 62,928 kilos.

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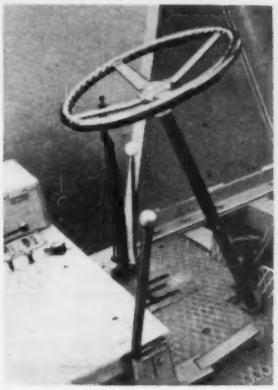

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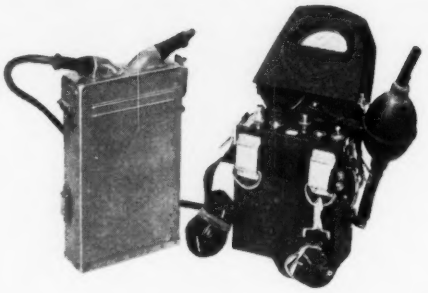

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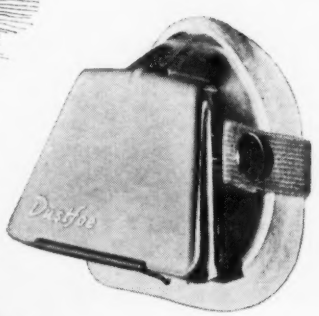

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Australia

By Our Own Correspondent

THE world-wide fall in metal prices has caused a re-adjustment in the mining industry ; small producers have been forced to close down by high costs and reduced selling price, and large producers have planned to meet the situation by increased output. Costs have continued to rise, though less steeply, mainly through the cost of labour and short working hours.

It was hoped that the long-deferred suspension of quarterly adjustments to the Basic Wage, granted by the Commonwealth Arbitration Court would halt the cost rise, but this benefit to industry has been nullified by union opposition and the sympathy of State Governments toward union demand for retention of adjustments, in the face of the decision of the Court.

Controls on the selling prices of metals in Australia have been removed on all but copper ; retention in this case is designed to give local producers some measure of protection because of the country's shortage of copper and because important work towards expansion in production, induced by past high prices, is well advanced by big mines.

METAL AND MINERAL PRODUCTION

	1951 (000's)	1952 (000's)	**1953 (000's)**
Gold ..... oz.	896	980	**1,060**
Silver ..... oz.	10,500	11,000	**11,000**
Lead ..... tons	166	157	**175**
Zinc ..... tons	186	196	**190**
Copper ..... tons	14	20	**35**
Tin ..... tons	1.5	1.7	**1.4**
Wolfram* .. tons	0.5	1.0	**1.1**
Scheelite* .. tons	0.9	0.9	**0.9**
Coal, Black tons	17,700	19,500	**18,507**
Coal, Brown tons	7,700	8,200	**8,240**
Iron Ore ... tons	2,430	2,800	**3,400**

* Concentrate, 65 per cent WO_3.

Labour, Prices and Costs

Although the labour position has improved, all mining has suffered from continued shortage of labour combined with high costs and short hours. Gold mining is precarious despite increasing popularity, and an increased price for gold is essential for the security of the industry. Decreased metal prices have lowered Broken Hill profits, but are not the serious factor there as with the lower grade Mount Isa Mines. Copper production is being increased, but here again, the future rests heavily on the metal market. In all the large gold and base metal mines prospects show signs of remaining good.

An important factor in meeting rising costs, particularly in gold mining, has been the use in development and stoping of light air leg combinations, with tungsten-carbide tipped steel, which has effected a great increase in tons-per-man-hour in all mines. Cost reduction has been further helped by other mechanization, there being marked increase in the use of shovelling and loading equipment assisted by the use of storage battery locomotives.

Colliery mechanization has made rapid advance, and the diesel locomotive continued to find favour, skips in all recent equipment being of 10 ton capacity. Costs, however, are steadily encroaching on the economies effected, and repetition in the future of the revolutionary aids to meet costs, as in the metalliferous mining industry, cannot be expected ; the future must look to much smaller savings coming from greater efficiency in an already efficient industry.

Taxation

Taxation of company income and shareholders' dividends continues to handicap the industry severely. Gold mining alone is exempt ; some other metals are exempt to the extent of 20 per cent of income and dividends, and this concession has been extended. Coal mining companies have received favourable treatment in regard to taxation by the Commonwealth Government.

Industrial Relations

Industrial relations have been fairly good ; there have been fewer strikes on the coalfields, and little disruption in metalliferous mining, excepting a strike at the mine of King Island Scheelite, resulting from demands for concessions on the Broken Hill scale. The wealth of the Broken Hill field causes difficulty in industrial arbitration, for few mines are in so fortunate position. A new agreement has been completed at Broken Hill granting long service leave, some increases in margins, and higher night shift rates.

Notable developments during the year were the discovery of high grade crude oil in commercial quantity at Exmouth Gulf, Western Australia, and the resulting stimulus to oil search ; the rapid growth of interest in prospecting for uranium; development of operations toward greater output by copper mines ; the planning of greater lead and zinc production by New Broken Hill Consolidated Ltd.; and the expansion in the use of sulphide minerals for the manufacture of sulphuric acid.

Gold in Western Australia

A heavy blow to gold mining was the suspension of sales of gold on the premium market by the Gold Producers' Association because of the fall in price. Nevertheless, this branch of the mining industry is advancing. Western Australia, the leading State, produced 818,516 f.oz. and the Commonwealth output was very close to 1,000,000 oz.

Ore reserve position on Western Australian mines has been well maintained. Lake View and Star has ore reserves of 3,735,000 tons with a grade of 4.81 dwt., while production has risen to 720,000 tons per year. North Kalgurli (1912) Ltd., with reserves approaching 2,230,000 tons, has the new five compartment shaft, 25 ft. 6 in. by 5 ft. 6 in. main shaft operating to a depth of 1,630 ft. Ore grade is 5.6 dwt. Great Boulder Pty. Gold Mines Ltd. increased production to 460,000 tons for the year, recovery being 4.65 dwt. per ton ; the diesel-electric power plant has been completed and costs approximate 2.8d. per kWh., which figure will probably be reduced. Grade of ore milled by Gold Mines of Kalgoorlie, with reserves of 580,000 tons, is 6.5 dwt. ; the leases of the Paringa mine were bought during the year, and will prove a very satisfactory purchase. Boulder Perseverance maintains reserves at about 330,000 tons of 4.9 dwt. ore and South Kalgurli at approximately 200,000 tons.

The cost position has been met very creditably by the mines ; costs range from 52s. 11d. at Lake View and Star, to 56s. 9d. at Great Boulder, 65s. at Boulder Perseverance, to 72s. at Gold Mines of Kalgoorlie, where development costs are heavy at present.

On all mines development has been satisfactory, both in the number and good grade of the smaller lodes located and opened up, which contribute substantially to ore reserves and output. In addition to discoveries at shallower levels, developments at depth in several mines are good.

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Results of deep diamond drilling by Kalgoorlie Southern Gold Mines to locate repetitions of the Golden Mile auriferous formations at the south end of the field are regarded favourably. Central Norseman Gold Corporation has developed well in depth at the north end, and the Princess Royal section is proving high grade; the mill throughput approximates 13,000 tons of 8.7 dwt. ore per month. New Coolgardie Gold Mines improved in tonnage and grade; throughput is about 65,000 tons of 10.7 dwt. ore per year and reserves are 117,000 tons; additional leases have been taken up. Great Western Consolidated is treating 33,000 tons per month of 2.46 dwt. ore; grade continues to be low, but higher grade leases are being prepared for working. Hill 50 Gold Mines are proving important, mining 10 dwt. ore.

Gold in the rest of the Commonwealth

In Victoria gold mining is at a very low level; company operation at Bendigo has ceased for the first time in its history. Only three lode mines of importance are in production, and three bucket dredging enterprises. The most notable lode mines is Morning Star (G.M.A.) Mines with reserves of 50,000 tons of 15.5 dwt. ore; the mine has been electrified and the main shaft is to be sunk 700 ft. to a depth of 2,700 ft.

In the Northern Territory, Tennant Creek continues to produce an important quantity of gold, the Australian Development mine, with reserves of 206,000 tons of 36.6 dwt. ore, having an output of 15,000 tons per year, the head value being 54.5 dwt. per ton; recovery by amalgamation is 72 per cent and tails assay 15.4 dwt.; the mill has been modernized and a cyanide plant is working on current tailings, bringing the overall recovery to over 90 per cent. Queensland relies on Mount Morgan gold and copper mine, and the recently rejuvenated Golden Plateau mine which now has prospect of 10 dwt. ore for some time.

Silver-Lead-Zinc

Broken Hill mining was notable for commencement of milling by New Broken Hill Consolidated which has raised throughput to 400,000 tons per year, and plans increased mining and milling capacity. Reserves are 2,500,000 tons assaying 10.6 per cent Pb, 2.6 oz. Ag, and 10.9 per cent Zn. Main and ventilation shafts are circular reinforced concrete, with depths approaching 3,000 ft.; cage and skip winders are 2,600 h.p. Important lead lode intersections by drilling have been made at a depth of 3,240 ft.

The adjoining Zinc Corporation Ltd. mine has reserves of 5,800,000 tons; grade is 14.7 per cent Pb, 3 oz. Ag, and 11.3 per cent Zn and rate of output over 450,000 tons per year. A fan of 900,000 cu. ft. capacity is to be installed to ventilate this mine as well as that of New Broken Hill.

Broken Hill South continued to maintain ore reserves at 1,900,000 tons and a high rate of milling efficiency. Ore persists downward at the south end of the mine, and the leases of the old Central, Proprietary and Block 10 mines are producing important tonnages of remnant ore from the upper levels. North Broken Hill treated ore assaying 13.7 per cent Pb, 7.2 oz. Ag, and 11 per cent Zn. Development is proceeding below the 3,000 ft. horizon, and the principal works are the sinking of the eliptical main shaft, and the circular ventilation shaft, both concrete-lined, and with steel sets.

The company is diamond drilling country north of the De Bavay fault, but with indifferent results so far. Mill recoveries were 97.2 per cent Pb, 91.9 per cent Ag, and 87 per cent Zn.

Mount Isa Mines, Queensland, maintained reserves of lead-zinc ore at 9,800,000 tons worth 8.5 per cent Pb, 6.9 per cent Zn, with output of 850,000 tons per year, recoveries being 81.8 per cent Ag, 83.6 per cent Pb, 53.1 per cent Zn. Throughput increased more than 200,000 on the previous year. The company is installing the first air-conditioning plant in Australia and a new ventilation shaft was being sunk. The northern prospect, in development, continues its promise of becoming a large, low grade open cut proposition.

Lake George Mines experienced a difficult year, mainly influenced by labour troubles.

Electrolytic Zinc Co. of Australasia has increased production of metal to an average of 7,700 tons per month, and has the sulphate of ammonia plant well advanced. The company's West Coast mines are producing at the rate of 16,000 tons of ore per month.

Copper

Mount Isa Mines came to the front as a copper producer with 15,700 tons of blister copper; reserves of copper ore are 3,900,000 tons assaying 3.9 per cent Cu. The copper lode is parallel to the lead lode, and both are worked through the same shaft, hauling 90,000 tons of combined ores per month.

At Mount Morgan Ltd. there has been an increase in grade of both gold and copper. The open cut is close to 850 ft. in depth; and about 900,000 tons of ore and 2,500,000 tons of overburden were mined, a proportion of the overburden coming from preparatory work on the Sugarloaf orebody; reserves are 17,000,000 tons; mill recoveries have increased and pyrite recovery is becoming an important feature.

Mount Lyell Mining and Railway Co. will carry open cut mining to greater depth, and this has permitted increase of ore reserves to 44,500,000 tons, containing an estimated 250,000 tons of copper. Advances are being made to increase production of refined copper and pyrite concentrate. Successful modifications have been made in the blast furnace.

Tin, Wolframite and Scheelite

Late in the year Tableland Tin Dredging resumed work in Queensland, and Australian production of concentrate will be raised by 60 tons per month. The principal lode mine, Aberfoyle Tin, has sunk the main shaft to 1,085 ft.; several long lodes, 12 in. to 24 in. wide, are being worked and production is at the rate of 45,000 tons of ore per year.

Fall in metal price has forced small mines to close down. Aberfoyle Tin remains the large wolfram producer; King Island Scheelite produced 170,000 tons of .49 per cent WO_3 ore and has reduced reserves to 2,300,000 tons.

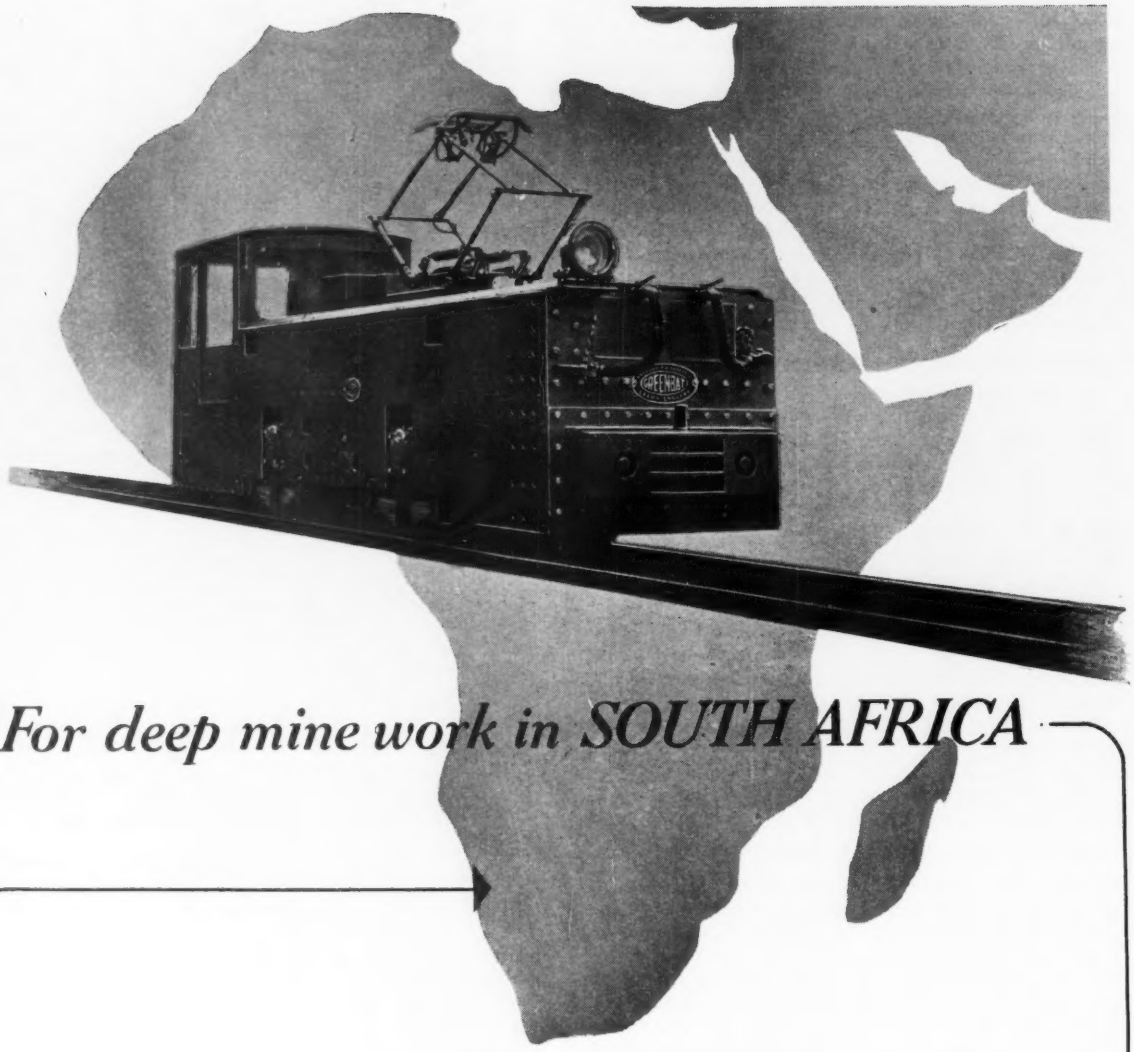
Uranium

Contrary to Press statements Australia has, as yet, no "great wealth" in uranium. Indications are widespread, but only two occurrences, Rum Jungle in the Northern Territory and Radium Hill in South Australia, can be, as yet, regarded as "resources." There has been much activity in company formation to prospect for the ores. Some producers may ultimately be established, but much money must inevitably be spent in the process. At Rum Jungle the ores are pitchblende, torbernite and autunite, and at Radium Hill davidite.

Oil and Coal

The discovery of crude oil, making at the rate of 20 bbl. per hr. at a depth of 3,600 ft., at Exmouth Gulf, Western Australia, has strongly rejuvenated interest in oil. Competent opinion states that further oil discoveries are inevitable.

Coal mining generally experienced great advance in mechanization and the technical approach to the industry. Heavy media coal cleaning plants are operating, and being erected in New South Wales.



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New Zealand

METALLIFEROUS mining in the Dominion suffered a further decline in 1953. This branch of the industry is represented almost entirely by gold dredging. The year commenced with six active dredges, but two closed down during the year. All lode gold mining has ceased.

Rimu Gold Dredging Ltd. shut down after producing gold to the value of £2,000,000, and a second company to cease work was Kanieri Gold Dredging Ltd., with one of the largest bucket dredges in the country; the original property has been exhausted, and the plant is being dismantled for removal to the neighbouring Taramakau area, which has a large available yardage. Snowy River Gold Dredging Ltd., also with a large dredge, is nearing the end of its life, having three years' ground remaining.

An important addition to the industry is the resumption of work by the large Arahura Gold Dredging Ltd.'s dredge, which sank in 1949, but has been raised and reconditioned.

Base Metals

Some prospecting for antimony and tungsten has been carried out. The most important effort in the way of base metals was the formation in London of Mount Radiant New Zealand Ltd., the objective being the investigation of mineral deposits in the Mount Radiant, Karamea, district.

Another base metal company formation is the Kawau Copper and Sulphur Co. Ltd., which intends to work copper pyrite deposits on Kawau Island, in Hauraki Gulf.

Oil Production

There was small, but steady, production of oil from the Moturoa field, near New Plymouth, the year's production probably being close to 4,500,000 gallons. A company, known as Egmont Oil Wells, intends to put down three bores at Moturoa with the object of determining if the field has prospect of becoming a larger producer of oil.

One interesting development is the connection of three oil wells at New Plymouth, owned by New Zealand Oil Refineries, with the works of New Plymouth Gas Co., so that natural gas can be blended with producer gas.

Sol Development Ltd proposed to produce oil fuels and by-products from coal in Southland.

Coal and Non-Metallics

The future of New Zealand mining rests with coal and non-metallics. There has been great development in coal mining, both underground and open cut, and extensive surveys have been made of coal resources. The main field of utilization is for generation of electric power. Production figures for the year 1953 are not available, but the order of importance of non-metallic minerals is coal, sand and gravel, limestone for agriculture, and building aggregate material. The value of these materials in 1952 was £N.Z.10,649,000.

The most interesting Dominion development for the year is the investigation into the use of geo-thermal steam applied to the generation of electric power. A geo-thermal steam station is proposed on the Waikato River, and plans are being prepared. A more immediate use for the steam is for process heating in the paper mill being established for Tasman Pulp and Paper Co. Ltd. The locality of this new source of power is in the Rotorua-Taupo volcanic region of the North Island.

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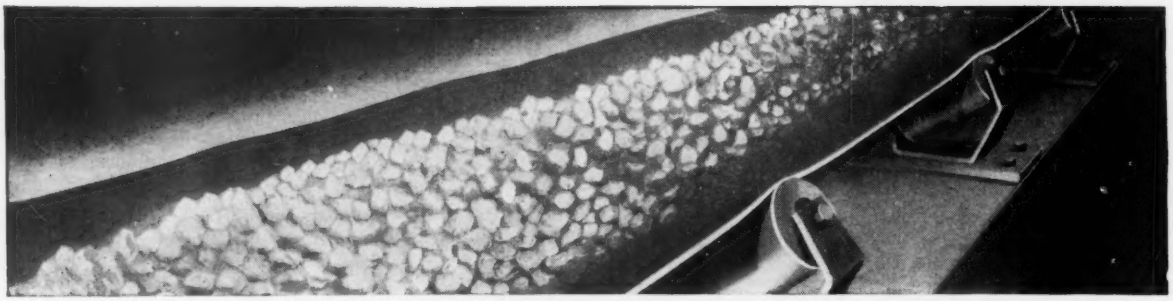

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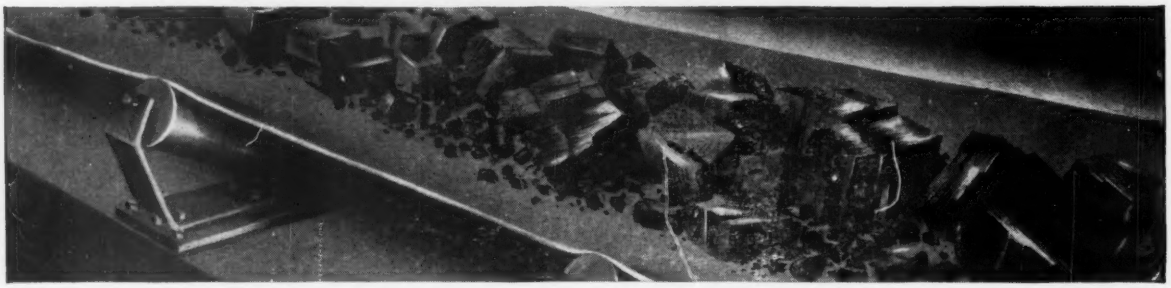

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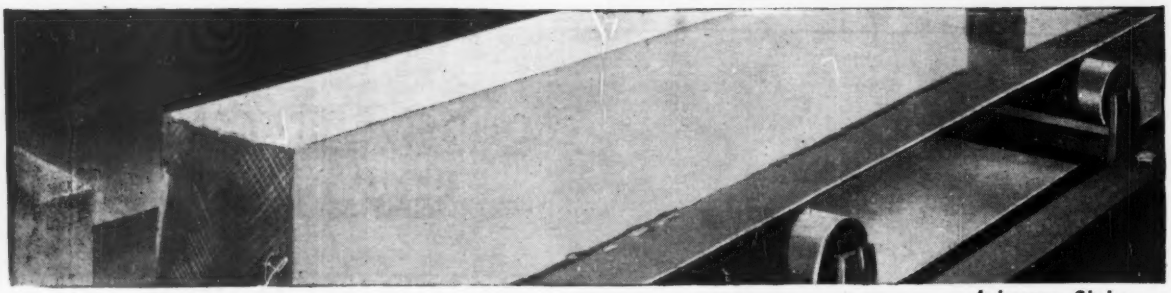

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The Philippines

CONSIDERABLE progress has been made in the rehabilitation of the Philippine gold mining industry. In 1953 the gold output amounted to 480,000 oz., compared with 469,408 oz. in 1952, the latter figure representing an increase of 12 per cent over the previous year. A number of pre-war producers have resumed operations during the past two years, among them being the Baguio Gold, San Maurico, and United Paracale mining companies.

Gold

Although the production of gold has been rising consistently, the fall in free market prices, together with rising costs and other problems, have made the past two years a particularly difficult period for the gold mining industry, which operated at a net loss of P.891,162.09. For the first time since 1946-47, the value of base metal production overtook that of gold and silver production, which it surpassed by more than P.6,000,000.

The Philippine Gold Producers' Association was formed in mid-1952 to present the industry's plight to the government and on May 21, 1953, a Bill granting tax relief to the gold mines was passed by the Philippine Congress. On the basis of 1952 tax payments, the industry anticipated annual savings totalling P.3,900,000. It is possible that the tax relief may also stimulate outside gold exploration, encourage the re-opening of pre-war mines, and enable producers to mine lower grade ores, thus reversing the present trend.

Chrome and Manganese

In 1952 the Philippines produced 543,514 tonnes of chrome, of which 491,150 tonnes were of refractory and the balance of metallurgical grade. Output in the first half of 1953 totalled 267,546 tonnes. The most important producers are the Acoje Mining Co., Consolidated Mines Ltd., and Luzon Stevedoring Co. Expanded exploration for chromite deposits is one of the most encouraging recent developments in the Philippine mining industry. Reserves of metallurgical chromite increased from 1,300,000-1,400,000 tons in 1951 to an estimated 1,700,000-1,800,000 tons at the end of 1952. Refractory chrome reserves are probably 8,000,000-9,000,000 tonnes.

Output of manganese ore declined to 20,627 tonnes in 1952, compared with 22,343 tonnes in 1951, and 29,867 tonnes in 1950. Production for January-June, 1953, was 12,290 tonnes. Only limited exploration has been carried out on the manganese deposits, except for surface drilling and trenching. According to a number of sources the small high-grade surface deposits are almost entirely worked out of saleable ore. The long-term outlook is questionable. The exact extent of exploration and development work is unknown and present reserves cannot be estimated. They are probably smaller than the 1949 estimate of over 500,000 tons.

Copper

Exploration activities for copper were greatly expanded in 1952 and early 1953, and significant achievements resulted. If present plans materialize concentrating mills will be constructed on several of the copper prospects. Several mining companies under the Soriano Group have pooled their resources to form the Atlas Mining and Development Co., which is to develop low-grade deposits in Cebu. Present plans call for a mill of 2,000 tons daily capacity and production will start early in 1954. The total Philippine production for 1952 was estimated at 13,241 tons of contained metal. At the end of 1951 reserves totalled 2,688,950 tons.

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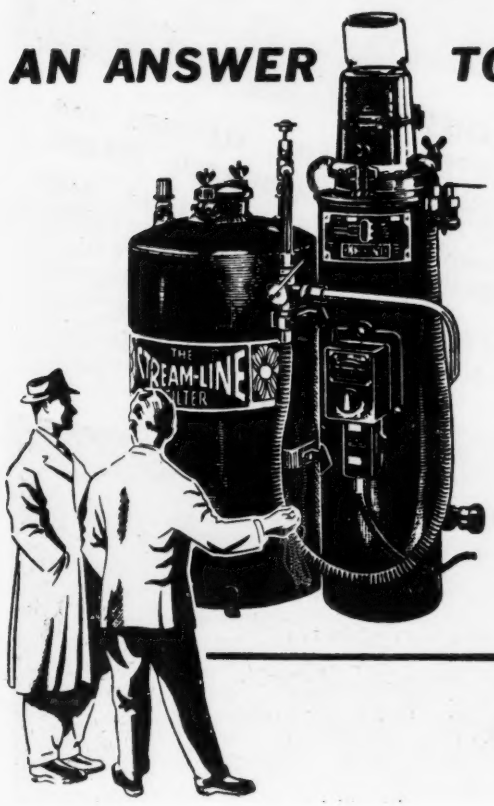

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Japan

THERE were two divergent trends in the Japanese mining industry in 1953. On the one hand certain sections suffered from high costs, the post-Korean weakness in demand, and growing foreign competition; on the other there was vigorous prospecting activity (a branch in which the industry has been traditionally weak) and hopeful reports were made of some of the newer metals, particularly titanium and germanium.

The outlook for Japan in 1954 is believed to be bleak in spite of the record levels of mining and manufacturing output in the autumn of 1953, and the industry must inevitably feel the consequences of Japan's seemingly chronic unfavourable trade balance.

Coal and Oil

The coal industry is the worst case. Its abiding problems are poor natural conditions, low labour productivity and slow rationalization because of capital shortage. In December, 1952, the longest recorded wage dispute ended and throughout 1953 there were recurrent strikes, mainly directed against the closing of uneconomic mines and the rationalization of others. In spite of these stoppages demand fell short of supply and the 1953 target of 52,000,000 tons was abandoned and output for the year reached 46,510,000 tons.

MINERAL PRODUCTION

		1952	1953
Coal	tonnes	44,898,000	**46,395,000**
Iron ore (concentrate)	tonnes	1,042,291	**1,113,369**
Crude oil	kilolitres	339,214	**334,078**
Electrolytic copper	tonnes	94,403	**90,930**
Aluminium	tonnes	42,658	**45,670**
Zinc	tonnes	70,029	**79,170**
Lead	tonnes	18,492	**22,553**
Refined gold	f.oz.	234,250	**281,500**
Refined silver	f.oz.	6,305,000	**7,635,000**

About 900 mines are now in operation, but 18 companies controlling 92 mines are responsible for 70 per cent of output. Reckless war-time mining added to the difficulties of an industry possessing many natural disadvantages. Much of the rationalization which was to have been its salvation was pushed through during the Korean boom and the industry now has high capital charges to add to its difficulties as it enters a period of reduced demand.

The metallic industries fared better and it was a hopeful sign that the 1953 Convention of the Metal Miners' Federation (Zenkoren) rejected many of the policies of the leftish Sohyo to which it is affiliated. New prospecting during the year included seismic coal exploration in a number of fields, refraction and reflection methods in Kyushu, spontaneous polarization resistivity and seismic surveys of pyrite deposits, self potential methods for the discovery of copper, lead and zinc, and a number of magnetic and electrical surveys for iron, tungsten and sulphide deposits.

Titanium and Germanium

Among the newer industries, titanium is making spectacular progress, production reached 150 tons in 1953 and is planned to reach 1,185 tons in 1954. There are extensive deposits of iron sand containing titanium oxide and the government has subsidized the change-over from experimental to commercial production. Output is at present exported to the United States and the United Kingdom but, as the Japanese aircraft industry revives, domestic demand should appear. The Osaka Titanium Company is the main producer.

Germanium is also now being mined for the first time at the Mitsui Mining Company's property at Kamioko, Funatsu. Germanium is also understood to be present in the Ohira mine, Oita prefecture, and at the Numagami mine, Hokkaido.

Iron Ore

Only about 40 per cent of Japan's iron ore requirements are met from domestic sources although production reached a new record high in 1953. The traditional sources of ore, China and Manchuria, now being blocked, Japan is attempting exploitation of orefields in S.E. Asia.

Copper

This is one of the few sections of the industry for which prospects remain bright. About 170 mines are working but five companies Mitsubishi Kinzoku, Nippon, Furukawa, Sumitomo Kinzoku and Dowa, produce about 85 per cent of the total output. Mine output still suffers from war-time depradations and ingot copper production has been for some years double that of ore output, thanks to impressive scrap drives and imports. The industry is active both in prospecting and mechanization. Nippon Mining and Smelting Company has constructed a unit for treating ores with oxygen at the Saganosiki smelter.

Lead and Zinc

The industry is feeling the consequences of a buyers' market but prospecting is active. Thirty-seven lead and zinc mines were active but the Kamioka and Hosokura mines accounted for 80 per cent of concentrates. There were seven lead and six zinc smelters. A 1,000 ton a month plant has been built by the Toho Aen Mining Company to treat zinc slag from its Annaka zinc smelter; Mitsubishi Metal Mining and Smelting Co. is to build a zinc smelter in Akita using Ikuno and Akenobe concentrates.

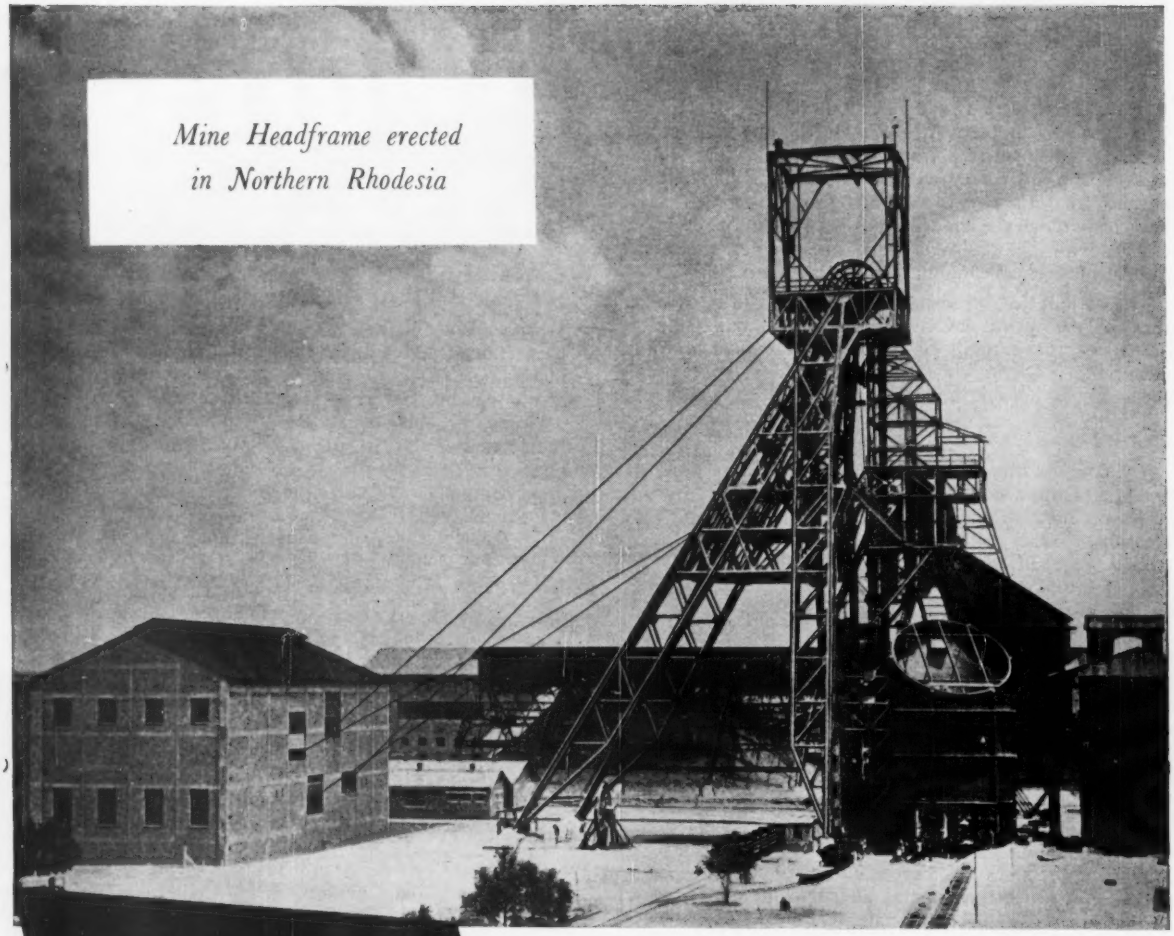
Aluminium

The aluminium industry is in a relatively good position, and has as its main advantage a good supply of relatively cheap electric power. The permanent weakness of the industry is the need to import bauxite, especially from Bintan, although the Japanese Government is prepared to assist in the exploitation of more conveniently situated ores; to this extent Japanese costs fluctuate with freight rates. Since the war the Japanese industry has been short of permanent demand and technical knowledge. The latter should be remedied by the agreement concluded in 1953 whereby Aluminium Ltd. of Canada bought half the share capital of Nippon Keikinzoku K.K. (one of the three producers and responsible for about 60 per cent of total output). The former difficulty may be intensified since the industry has benefited substantially from American special purchases which may now be declining. There are alumina plants at Shimizu, Yokohama and Kikumoto, and aluminium plants at Kambara, Kitaka Omachi and Kikumoto.

Gold

The big event of 1953 was the return to free gold sales. Due to price regulations the industry's mines were rapidly closing when in August, 1953, free sales were allowed. Hitherto the producers had to sell to the government at Y405 a gramme ($35 an oz.) who sold it back at Y407; the producers could then sell to processors at Y512; average production cost was claimed to be Y679 a gramme.

Permission was granted to sell 66 per cent of output at the market prices (the remainder to be sold as before to the government). On August 1 the free price was Y555, by October it had risen to Y570 and has since risen further.



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Malaya

MINERAL producers in Malaya have long been operating under the constant threat of Communist guerilla attacks. In 1951, when terrorism was at its peak, over 6,000 "incidents" were recorded. In 1952 the number was reduced to 3,700 and a total of about 1,100 for 1953 indicates further substantial progress. Nevertheless, the high Commissioner stated in July that he could see no end to the state of emergency called five years ago. He estimated that there were probably more than 5,000 terrorists in the jungle and possibly up to 6,000. The number might be further cut down, but there would probably remain beyond reach a small hard core who would never stop until they received orders from outside.

Owing to the improvement in the security position, it became possible during the year to allow exploratory operation in some areas, but it is impossible to say when prospecting of new ground on a substantial scale can again be undertaken. It is estimated that some five years will be necessary to install new dredges in stanniferous land yet to be located at a cost of something like £1,000,000 for a big new installation. Moreover, the high level of exproprietary taxation makes it doubtful whether capital for adequate development would be forthcoming, even if new ground were available.

PRINCIPAL MINERAL OUTPUTS

	1951	1952	**1953**
Tin-in-concentrates .. tons	57,167	56,838	**56,254**
Coal ..... tons	382,539	315,922	**286,364**
Bauxite ..... tons	4,047	21,796	**152,170**
Gold* ..... troy oz.	17,018	19,806	**18,283**
Scheelite and wolfram tons	46	68	**129**
Iron ore ..... tons	846,803	1,055,506	**1,062,678**
Ilmenite† ..... tons	43,493	21,698	**26,570**
Columbite .....tons	—	—	**52**

* Sales. † Exports.

This aspect of Malayan economy was underlined by the critical situation presented by the steep fall in prices of the country's two most important products, tin and rubber. Conferences were arranged between the government and tin producers to consider what could be done. It was estimated that marginal producers — more particularly small mines and low grade opencast and gravel propositions —would be unable to operate at a profit with prices below $400 (Malayan) per pickul (133⅓ lb.). In the circumstances, reduction of taxation and royalty were seen by producers to offer the most helpful prospects.

The International Tin Agreement

In August, the Malayan and Straits governments were reported to have announced officially that they supported reconvening of the International Tin Conference. Some producers maintained, however, that Malaya was in a strong position vis-a-vis other producing fields, and that an international control scheme was not in its best interests.

After referendums among both European and Chinese mineowners the Legislative Council gave its support by a big majority to ratification of the proposed Geneva International Tin Agreement. If this agreement comes into force Malaya will be responsible for contributing about 36½ per cent of the 25,000 tons of tin required for the buffer stock.

This will be called up in three instalments, of which the first will be 15,000 tons. Financing Malaya's contribution of 5,500 tons—estimated at about Straits $50,000,000—is one of the difficulties in the way of acceptance. The threatened burden would be eased, however, by an arrangement whereby the U.K. Government would lend Malaya enough money to finance its contribution to the buffer stock, the loan being paid off gradually through a levy on the industry.

The prospects of the proposed Agreement being ratified received a setback when the United States Government announced in March, 1954, its intention not to sign, while making it clear that the scheme had its benevolent neutrality. Fears have been expressed that this decision might precipitate a shut-down of producers who had been working unprofitably for some months. On the other hand, it has been pointed out that in past depressions Chinese producers have shown a surprising facility for maintaining production at sub-economic prices.

Tin Production Steady

It is noteworthy that, despite all difficulties, production of tin-in-concentrates for the fourth quarter at 14,843 tons was the highest of the year. The 1953 total of 56,254 tons compared with 56,838 tons in 1952, this drop of 584 tons being less than seemed probable at any time during the year. Its smallness was due to a very substantial increase in dredge production to 2,906 tons of tin - in - concentrates in December; the highest monthly production by dredges since 1941. Nevertheless, dredge production during 1953 was below the previous year's total for the second year in succession. On the other hand, gravel dump production again showed an increase in spite of decreases in the average number of mines working in both periods.

Dredging accounted for 182,122 pickuls of tin ore and gravel pumping for 7,030 pikuls by Europeans and 110,085 pikuls by Chinese. At the end of December, 1953, there were 629 tin mines operating, of which 76 were dredges, 482 gravel pumps, 4 hydraulicing, 1 opencast, 10 underground and 46 small workings without machinery.

Other Mineral Production

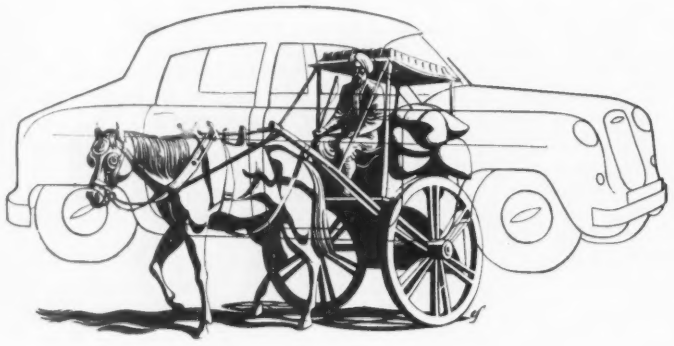
Columbite has been produced in small quantities from Semiling, in Kedah, and from Bakri, in Johore. Interest is also being taken in the columbium and tantalum oxides in slags produced at the tin-smelting works of the Straits Trading Co. and Eastern Smelting Co. Traces of columbite have been noted in alluvial tin concentrates elsewhere.

The Aluminium Laboratories Co. at Pengarang has proved an economic deposit of bauxite and obtained a lease over 3,000 acres. The company's parent organization, Alcan, has an agreement with the Nippon Light Metal Co., to whom the bauxite is likely to be shipped.

Coal production showed a further decline last year. Underground production is slowly increasing, however, and a new opencast mine with a very favourable overburden to coal ratio will start production next year. Owing to the recent decrease in the cost of fuel oil the demand for local coal has now slackened.

The Eastern Mining and Metals Co., whose Bukit Batu Besi mine doubled its production of iron ore in two years, is carrying out investigations at Ulu Rompin, in south-west Pahang, in order to develop further a large deposit.

A World Bank mission visited Malaya early in 1954 to make the first full survey of the territory's economic needs and to assess the amount of a World Bank loan. Among the points on which the mission planned to concentrate were expansion of iron ore mining, development of electrical power, encouragement of secondary industries, and replacement and improvement of railway rolling stock.



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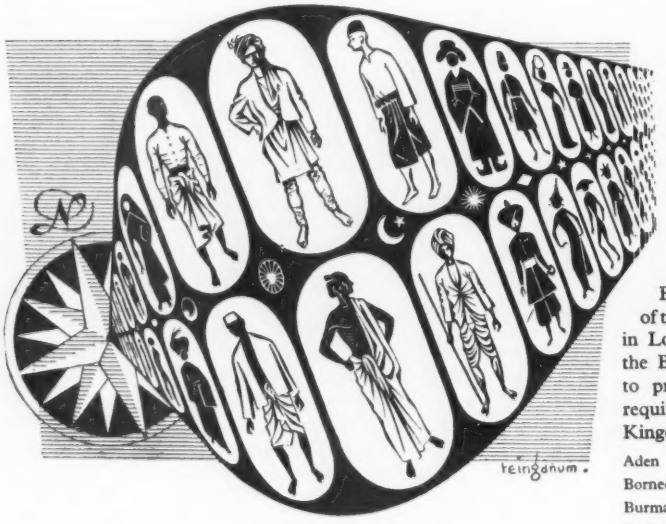

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India

By A. GRAHAM THOMSON

THE first Five-Year Plan (presented to the Indian Parliament in December, 1952) includes detailed mapping and proving of reserves; collection of detailed mineral statistics; investigations of coal seams and of coal-washing, blending, carbonization, hydrogenation and briquetting; and investigations into the manufacture of optical glass, ceramics and refractories. The total expenditure earmarked for mineral development under this Plan is Rs.10,610,000.

Coal

Exports of coal from India declined last year to 1,296,252 tons against 2,622,290 tons in 1952. There has been an upward trend in the production of most mineral commodities, however. Exports of magnesite totalled 45,474 tons against 38,643 tons in 1952, while shipments of manganese ore rose from 690,000 tons in 1952 to 903,542 tons last year. The changed supply position has been reflected, however, in lower prices for good grade Indian manganese ore. Shipments are subject to an *ad valorem* duty of 15 per cent, India being apparently the only country which levies a duty on exports of manganese ore.

Manganese

According to the Geological Survey of India about 500,000 tons of manganese ore are available in deposits in the North Kanara district of Bombay State. Although this ore is of low grade, there is thought to be scope for its utilization after processing. The Indian Bureau of Mines has undertaken experiments on the beneficiation of low-grade manganese ore from Madhya Pradesh. Low-grade ores from Katchindana mines were studied and the results of the investigations have been published. A heavy media separation plant was being installed by the Central Province Manganese Ore Co. Ltd., at its Dongri Buzurg mines for the beneficiation of low-grade ore.

Chrome

As a result of further investigations, the known chromite deposits in the Singhbhum district of Bihar and the Keonjar district of Orissa have been increased from an estimated 200,000 tons to 2,120,000 tons. Further chromite deposits recently located in Sukinda State in Keonjar are being explored. Last year exports of chromite ore amounted to 16,011 tons compared with 6,210 tons in 1952. The export of 15,000 tons, irrespective of grade, has been sanctioned for January-June, 1954.

India's known reserves of non-ferrous metals are inadequate. The Five-Year Plan envisages a thorough examination of all occurrences of copper, lead, zinc and tin ores. Copper production reached 7,197 tons in 1951, but dropped to 6,176 tons in 1953, and averaged little over 400 tons monthly in the first quarter of 1953.

Lead and Zinc

The production of lead and zinc is in its infancy. The output of refined lead rose to 1,150 tons in 1952, and a higher production was expected in 1953. A Rs.3,000,000 development loan has been granted to the Metal Corporation of India, which is exploiting lead-zinc mines near Jaipur with a daily output of 150/200 tons. Zinc concentrates totalling 3,300 tons were exported in 1952. A committtee has been set up to advise on the establishment of a zinc smelter plant.

Aluminium

India is producing about 70,000 tons of bauxite annually, less than half of which is used in the manufacture of aluminium metal. The expansion of aluminium production envisaged in the Five-Year Plan will increase this demand to 45,000 tons by 1955-56. Rated capacity is to be increased to 20,000 tons of primary ingots by the end of 1955 and steady progress is being made towards this target.

Ilmenite—Kyanite—Sillimanite

Practically the entire output of ilmenite—over 200,000 tons annually—is exported. Travancore Titanium Products Ltd.—India's only producer of titanium oxide—resumed operations in January, 1953, after closing down in mid-1952 owing to lack of internal demand for its products. The Government helped the factory to re-open with a loan of Rs.1,500,000.

Exports of kyanite and sillimanite continue to be controlled by quotas. A substantial industry has recently been established for Assam sillimanite near Nongaweit. Sillimanite boulders are quarried and made into furnace blocks at Calcutta, smaller ores being crushed and sold to refractory manufacturers.

Rare Earths

Rare earth chlorides and carbonates, tri-sodium phosphate, caustic lye and thorium nitrate are now being produced by the Indian Rare Earths Factory, Alwaye, Travancore-Cochin, which was formally opened on December 24, 1952. This factory can produce a maximum of 1,650 tons of chlorides or 1,150 tons of carbonates. The residue will be treated by a factory set up by the Atomic Energy Commission for the production of uranium and thorium compounds. The normal output will be about 205 to 228 tons of thorium nitrate and uranium will also be extracted. This plant is expected to start production in 1954.

Gold

Last year the gold output from the Kolar field amounted to 211,125 oz. compared with 242,233 oz. in 1952. Ooregum, one of the first gold mining companies operating in this field, decided to close down its mine—the deepest in the world—which had been operating at a loss of about £175 a day since January, 1953. It has been producing gold for 75 years. The possibility still remains of working the deposits in the lowest levels of the mine through an extension of the workings in the adjoining Champion Reef mine.

The outputs of individual producers in 1953 were: Champion Reef 54,962 oz. (66,477 in 1952), Mysore 70,593 oz. (74,729), Nundydroog 65,640 oz. (65,165), and Ooregum 19,929 oz. (35,862).

Mica

Although 12,046 tons of mica were exported last year, a slackening in demand has been reported. The Damodar Valley Corporation—India's "T.V.A."—was able to supply electricity to the Hazaribagh mica mines and greater output was expected, but exports to the United States declined, causing many mines to close down. The Indian Standards Institution was reported to be preparing standards for grading and classification, which could be internationally acceptable. The Indian Government and the German combine of Krupps and Demag have signed three agreements for setting up a Rs.700,000,000 steel plant in India with an initial capacity of 500,000 tons annually, rising by stages to 1,000,000 tons.

Ceylon *By Our Own Correspondent*

THE mining industry in Ceylon was exceptionally quiet during 1953. As usual, graphite was the island's principal mineral product, but the high level of activity prevailing in 1952 was not maintained. Exports of graphite declined last year to 7,218 tons valued at Rs.3,888,752, compared with 7,659 tons valued at Rs.6,199,606 in the previous year. The United Kingdom took 42 per cent of the total shipments of graphite, the United States 21 per cent, and Japan 20 per cent.

The island's ore reserves of graphite are believed to be considerable, and with more mechanized mining at depth the country will be able to maintain a much larger annual output at a relatively lower cost of production.

Ceylon is now concentrating beach sands by magnetic separation in a pilot plant at Katakurunda. Exports of refined monazite sand, containing between 2 and 22 per cent of thorium, are expected. The pilot plant gave satisfactory results last year, a total of 50 tons of monazite valued at Rs.104,625 being produced.

Mica was formerly Ceylon's second largest mineral product, but this industry has been dormant for several years, apart from a renewal of activity during the second half of 1952, when 179 cwt. valued at Rs.3,122 were exported. This revival was not maintained, for no mica mines were worked in the island during 1953. However, a parcel of some 6 tons of crude mica valued at Rs.432 was exported.

Ilmenite, Rutile and Zircon

The Government of Ceylon proposes to set up an ore-dressing plant for the refining of beach mineral sands from extensive deposits, which are found mainly at Pulmoddai, near Trincomalee, on the east coast of the island. This project has been deferred for the time being on account of the existing financial situation. Meanwhile, the government is considering the sale of a limited quantity of raw ilmenite-bearing sand from the Pulmoddai deposits.

Gem Mining

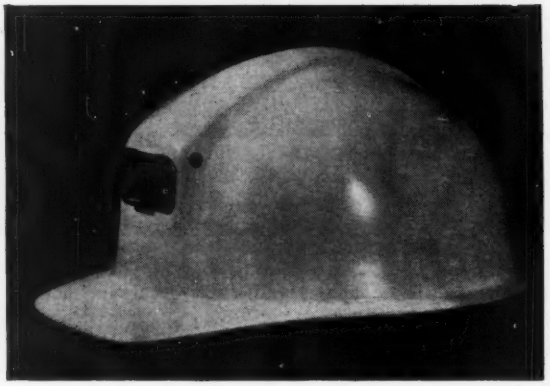
Precious and semi-precious stones are found in considerable variety, principally in the alluvial gravels of the Ratnapura district in Central Ceylon, and in the south-west section of the island. The most important varieties are sapphire and ruby, chrysoberyl (including cat's eye and the rare stone alexandrite); beryl; and the semi-precious stones such as topaz, spinel, garnet, zircon, tourmaline, and the gem varieties of quartz. No statistics of annual production are available, since the gem mining industry is not conducted on a commercial scale.

There was a small production last year of kaolin, quartz and felspar, all of which were used in the local ceramic industry. There was also a small production of glass sand for the local glass industry.

Gold Discoveries

The possibility that gold may exist in commercially payable quantities on the island has been indicated by the assay values of specimens of quartz taken from two districts in Central Ceylon. Dr. Kulartnam, a member of the panel of consultants of the American Institute of Mining and Metallurgical Engineers, believes that favourable geological conditions exist. He suggested that a geological survey for gold occurrences should immediately be undertaken.

TOUGH and MOISTURE PROOF



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Pakistan

A NEW three-point programme for the economy of Pakistan was announced last year by the Prime Minister, Mr. Mohammed Ali. It embraces the achievement of a substantial food surplus, increased industrial production, and exports of raw materials and manufactured products. Mineral development is of basic importance to this programme.

Development of Mineral Resources

The largest air survey ever made of the country's resources is being undertaken at a cost of $2,000,000. It is financed from a $10,000,000 fund set up by Canada under the Columbo Plan, will cover 165,000 sq. miles, and is scheduled for completion in 1956.

Early in 1953 a committee representing the Pakistan Mine-Owners' Association submitted a memorandum to the Minister for Industries which suggested ways of helping the development of the mining industry in Baluchistan. The Committee recommended better roads and transportation facilities, revised coal prices, granting of permission to buy truck tyres and suspension of restrictions on chromium and on prospecting rights and leases.

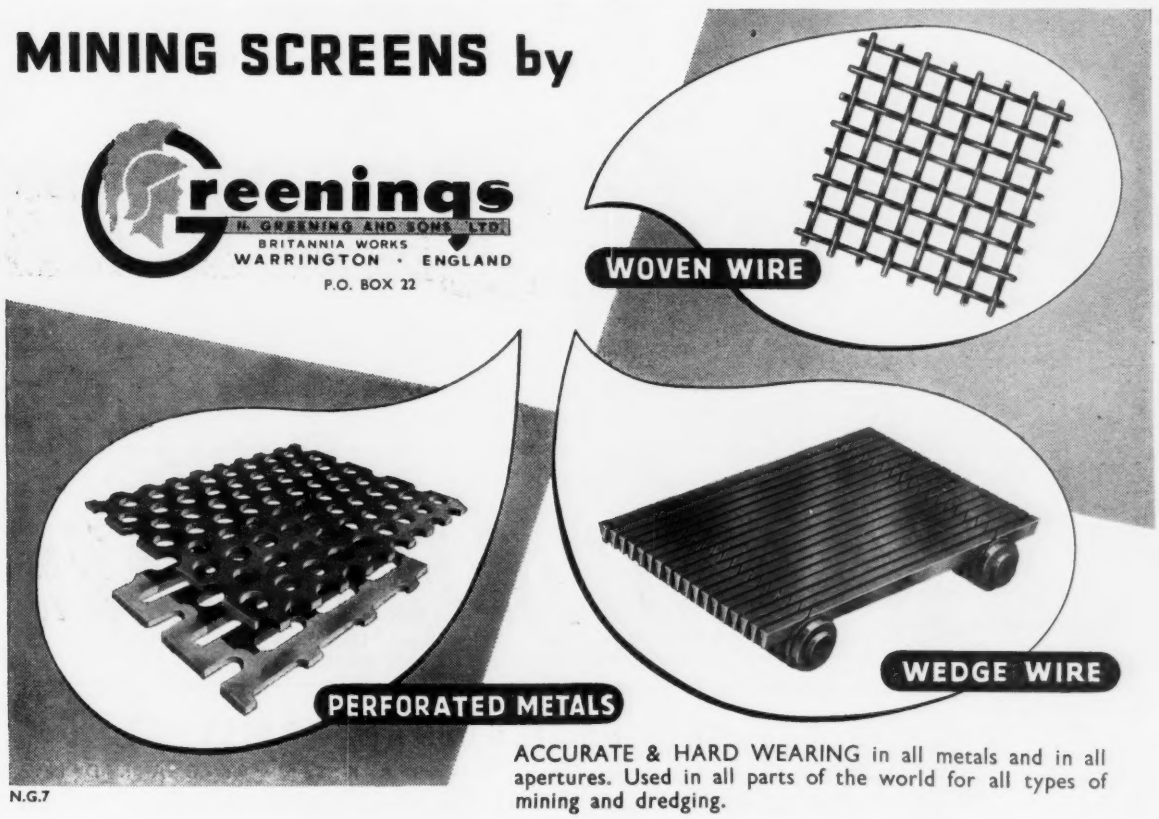
Pakistan is the second largest producer of chromite in Asia and the Far East. The deposits are situated in and near Hindubagh, in the Zhob and Quetta-Pishin districts of Baluchistan. In the past 30 years some 600,000 tons of chromite have been mined and exported. The average chromium content is 47 per cent, but in small patches very pure ore is found. Production has shown a marked increase since partition, rising from 17,230 tons in 1952 to 19,280 tons in January-October, 1953.

Pakistan produced 599,000 tons of coal in January-October, 1953, compared with about 467,000 tons in the whole of 1952. There is an increasing production of limestone, which amounted to 719,700 tons in January-October last year, compared with 702,478 tons in 1952.

Oil was found in what is to-day Pakistan as long ago as the 19th century, and the first commercial discovery was made in the 1930's. Prospecting for new oilfields is currently being carried out by British and associated Pakistani interests in Baluchistan, the N.W.F.P. and East Pakistan, as well as in the Punjab. A number of exploratory boreholes have been drilled. A production of 49,000,000 Imperial gallons is recorded for January-October, 1953.

Extensive Gas Supply

The discovery of an extensive gas pool at Sui was made by Pakistan Petroleum Ltd., a subsidiary of the Burmah Oil Company, while drilling for oil in Baluchistan in 1952. This gas will be piped to Karachi through a 16 in. pipeline about 350 miles long and will enable Pakistan to distribute the cheapest fuel in the East. It is estimated that the natural gas will supply a heating value equivalent to about 1,600,000 tons of coal per annum. The Commonwealth Development Finance Company is investing the rupee equivalent of about £1,000,000 in the equity of the Sui Gas Transmission Co. Ltd. The total capital cost of the project is estimated at £9,000,000 and application has been made to the World Bank for a loan of approximately £5,000,000, the remaining £3,000,000 of the equity capital being provided equally by Burmah Oil, the Pakistan Industrial Development Corporation, and by private investors.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Turkey

THE two most important facts about the Turkish mining industry are first that no geological map exists on a scale larger than 1 : 800,000 (figures for reserves of important deposits are consequently still only tentative) and secondly that in the early months of 1954 two laws, one in respect of all industry and one in respect of the oil industry, were passed to encourage foreign investment.

That the long-term prospects of the industry may be deemed good was the opinion of Mr. Clarence Randall, after his visit to Turkey, not merely because the country is still capable of much further development, but also because the necessary capital should now be forthcoming. The only doubt about the future is that Turkish development is putting a considerable strain on the balance of payments because the rising imports bill is not being met by the present export programme. Many products of the rapidly expanded Turkish agricultural industry have for two years past been priced above world market levels and it may be that, in the testing time for metals that lies ahead Turkish mining may feel the pressures of high costs and low prices.

Turkish statistical information is notoriously weak but it officially forecast that coal production will rise by 54 per cent between 1952 and 1955, and in the same period output of lignite, copper and chrome ores will rise by 66, 11 and 22 per cent respectively. Turkey's chrome output is discussed more fully on page 39. Production of crude petroleum was planned to reach 70,000 tons in 1953 and to advance to 270,000 tons by 1956.

Government's Aims

The Turkish Government has in fact two general aims for the mining industry (apart from that of generally increasing all mine output). The first is to increase the proportion of private, which by inference means foreign, investment because of the low level of domestic saving.

The second aim is to concentrate on power production. In part, of course, this means developing hydro-electric power. But it also means expanding coal and oil output to satisfy the growing demand of industry.

Importance of the Oil Industry

The main hopes are being pinned on the oil industry. The Raman wells are so far the chief source of production but prospecting is going on in that area, and particularly around Antalya and around Konya.

The lead mine at Keban has also been nationalized and now produces concentrates at the rate of 2,300 tons a year.

A good deal of work is still being done on the Divrik and Karabuk iron mines and the new installations are not expected to be completed before 1955 when output is expected to reach 450,000 tons, about double the rate before modernization was put in hand.

The construction of sulphuric acid plant at the Murgul copper mine was also contracted for. Copper is the only ore of importance in which Eti Bank retains overwhelming interest. Completely reorganized since the war, it is claimed to be among the world's most modern mines. 1,500 tons of ore are raised daily by 1,500 miners and the ore is transported by overhead cable to the plant 2½ kilometres distant. The average copper content is about 5 per cent, but some ores reach 8 per cent. The output of copper is about 40 tons a day. Reserves are believed to exceed 13,500,000 tons.

There have been unconfirmed reports that the bauxite deposits might be worked in the near future ; these are mainly near Zonguldak, near Aseki in the Taurus mountains and near Payas, estimated at 5,500,000 tons.

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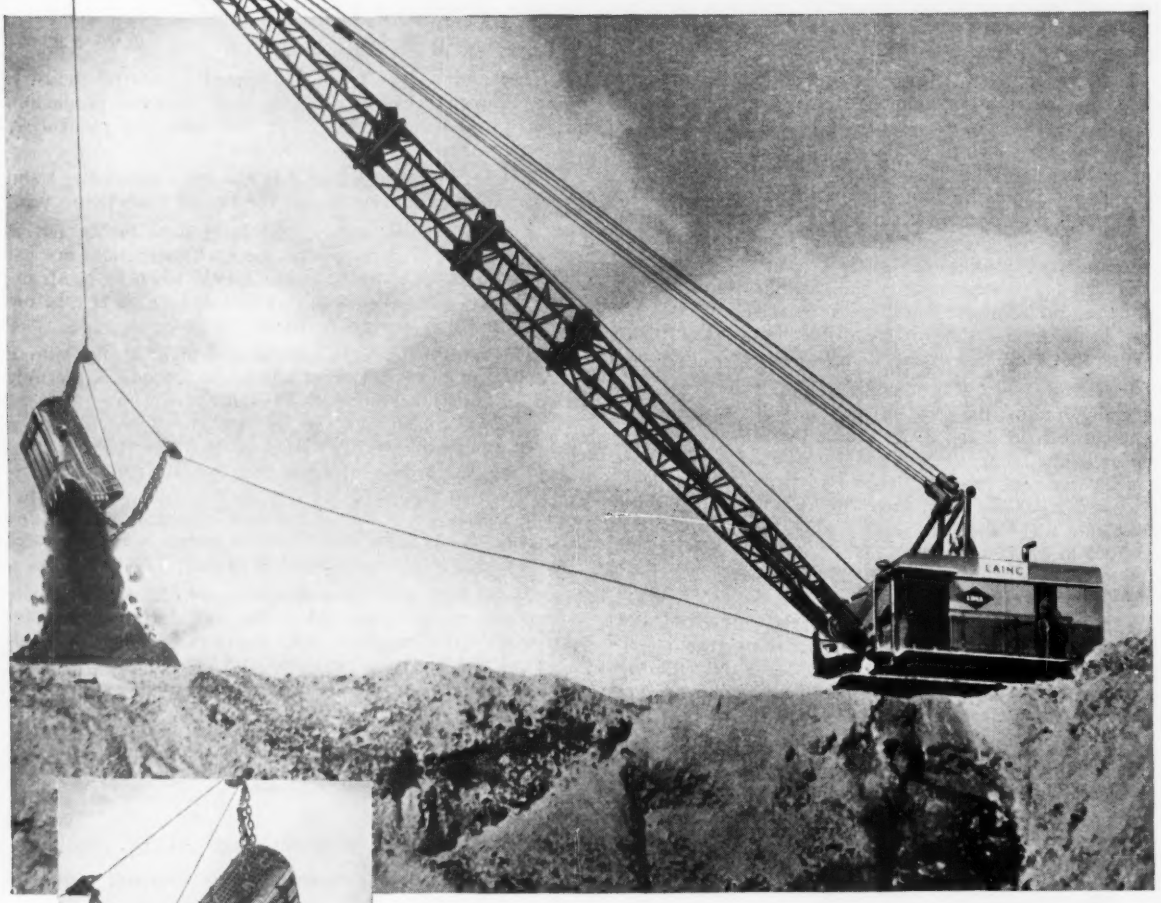

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Cyprus

THE island of Cyprus, slightly smaller than Devon and Cornwall, began its mining history in pre-historic times, but for many centuries its mineral riches were neglected.

In recent years production has been greatly expanded and in 1952 exports of minerals reached £10,264,000, setting up a record for the fourth successive year. The decline in prices is mainly responsible for a steep drop in the aggregate value of minerals exported during 1953, the total figure for the year being estimated at about £7,000,000. Shipments of cupreous pyrites declined to 129,915 tons (146,672 tons in 1952) and copper concentrates at 81,085 tons were also lower. Exports of iron pyrites totalled 565,183 tons (633,270 tons in 1952).

Importance of Mining Industry

Since mining is responsible for approximately half the total wealth of Cyprus, the discovery of fresh mineral deposits is of the utmost importance to the island's future. Prospecting and development are being vigorously carried out by the principal mining companies, two of which are using geophysical methods. Two newly discovered pyritic orebodies are being mined in the Kambia and Mitsero areas, the large one being estimated to contain between 1,000,000 and 2,000,000 tons of ore.

The island's largest mineral producer is the Cyprus Mines Corporation, which in 1952 mined the record quantity of 743,560 tons of cupreous pyrites. The ore was railed to its concentrating plant at Xeros, which has a total capacity of 60,000 tons per month. The output included 100,000 tons of copper concentrates averaging 18.04 per cent Cu., 457,921 tons of flotation pyrites (50.3 per cent S.), and 2,273 tons of cement copper (70.4 per cent Cu.). An acid leaching plant was completed in 1952 at a cost of £500,000.

The Hellenic Mining Co. Ltd. operates a pyrites mine at Kalavasis. In the Sha section of its Kambia-Sha lease, open-cast mining of a comparatively small iron pyrites orebody is being carried on. In the Kambia section a pyrites body originally discovered in mining gold ore many years ago has been defined by drilling and is now being mined. In the Mitsero-Agrokopia area a deposit previously prospected with disappointing results has proved to be an iron pyrites orebody of some importance.

Esperanza Copper makes Good Progress

The Esperanza Copper and Sulphur Co., the wholly owned subsidiary of The Cyprus Sulphur and Copper Co. Ltd., has made good progress with opening up a new orebody found at the end of 1950 in the Kinousa section of its 30 sq. mile property. Stoping was started in 1952 and shipments of ore were resumed in May, 1953. Currently the Evloimeni section, some 1¼ miles from Kinousa and 1 mile from the main Limni workings, is being developed with good values of copper, zinc and sulphur encountered.

Asbestos is quarried by Cyprus Asbestos Mines Ltd. from a deposit in the Troodos mountains. In 1952 this company produced 16,294 tons of fibre from 1,842,403 tons of rock. Exports of asbestos in 1953 dropped to 9,200 tons. Production by the Cyprus Chrome Company Ltd. from their mine in Troodos amounted in 1953 to 7,277 tons of chromite, yielding 6,402 tons of concentrates.

Detailed mapping of selected areas on a scale of 1 : 5,000 is being undertaken by the Geological Survey. Owing to complicated geology necessitating very detailed work, this scheme will take longer than expected.

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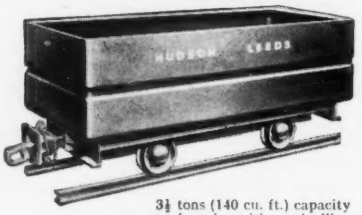

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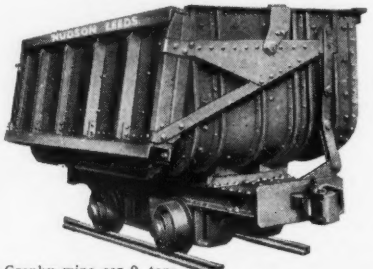

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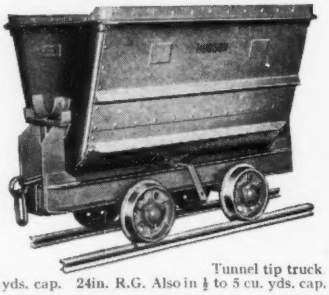

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Yugoslavia

LAST year, Yugoslavia again made substantial progress in the development of industries based on exploitation of her rich mineral resources. Particular attention is being devoted to non-ferrous metal industries, the main objective being to switch from exports of ores and concentrates to semi-manufactures and finished goods. The Yugoslav economic authorities have allocated Dinar 5,800,000,000 for the construction of the big Strnisce aluminium works in Slovenia. The programme called for the production of some 50,000 tonnes of alumina and 15,000 tonnes of crude aluminium during 1953 and aluminium output is to be stepped up to 80,000 tonnes in 1954. Most of this increased output will be exported.

Basic Industrial Expansion

Yugoslavia's original "Five-Year Plan" over-taxed the country's resources and has been revised several times in recent years. In its present form it provides essentially for the completion of schemes in basic industries, such as electric power stations, oil refineries, a copper-processing mill, and the expansion of coal mining and cement manufacture. A number of plants were scheduled to come into operation during 1953.

During the first ten months of 1953 Yugoslavia produced an average of 6,021 tons of lead per month, or 500 tons more than the monthly average for 1952. The Yugoslav National Bank has approved the grant of a foreign currency credit to the lead mine at Mezice, Slovenia, to be used for expanding production.

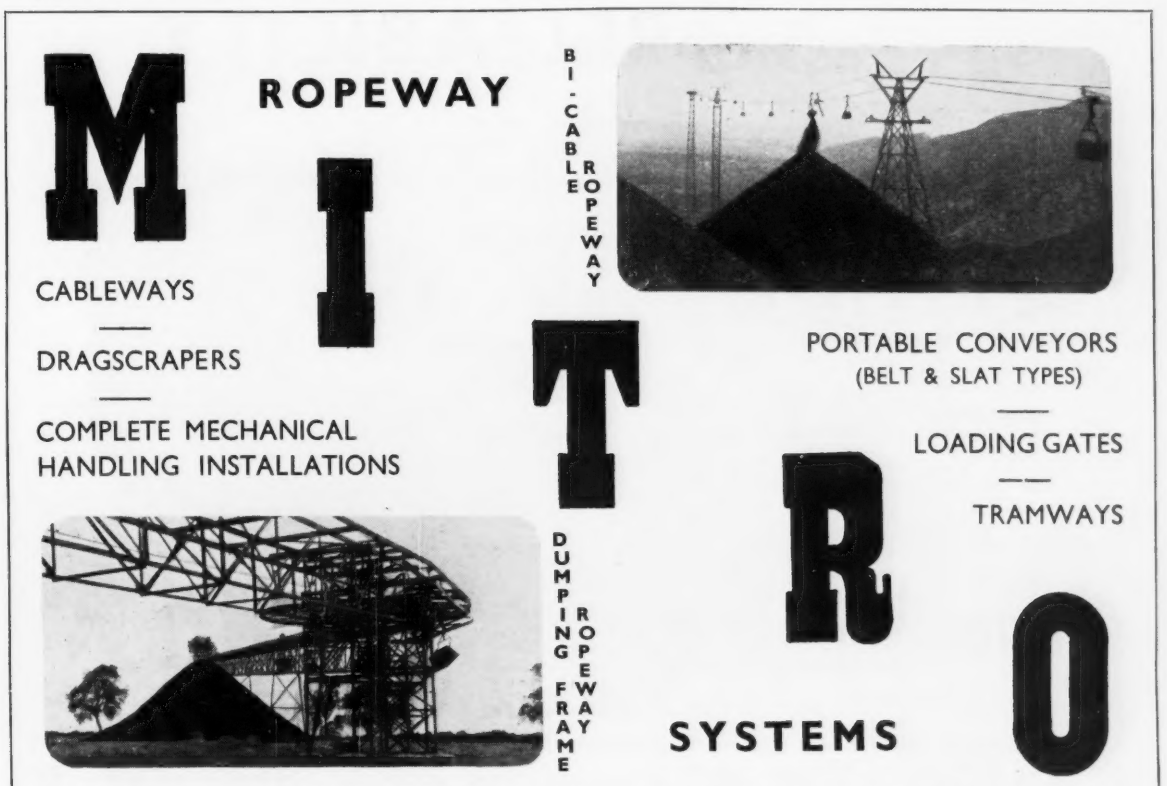
A new chrome ore separation plant is to be built in the vicinity of Djakovica in the autonomous province of Kosmet, Siberia. Ore will be dressed on vibration tables by the wet-gravitation method. The main products will be large grain and fine grain concentrates, the former for use in the production of chrome-magnesite bricks and the latter to be processed at the new chrome compounds works at Regusa.

During the first half of 1953 production of mercury amounted to 245 tonnes, compared with 504 tonnes in 1952 and 378 tonnes in 1939. The value of mercury exports has risen from Dinars 124,329,000 in 1951 to 741,478,000 in 1952, and amounted to 366,560,000 in the first half of 1953. Almost the entire Yugoslav production of mercury comes from the well-known mine in Idrija, which has gradually been mechanized in the post-war years.

Increased Electric Power Consumption

According to expert estimates, Slovenia's industry will be using 30 per cent more electric power in 1954 than in 1953. In subsequent years the increase in consumption will be even more spectacular. Once it reaches full production the Strnisce aluminium plant alone will be using about one milliard kWH. Another large consumer will be the Store ironworks. In order to meet these expanding power requirements a number of hydro-electric stations are being constructed and others are projected.

Industrial expansion is also resulting in an increasing demand for solid fuel and steel. Coal production during January-October, 1953, amounted to 8,990,000 tonnes, compared with 12,098,000 tonnes in 1952 and 6,973,000 tonnes in 1939. Steel output showed a marked increase during the year at 512,000 tonnes compared with 442,000 tonnes in 1952.



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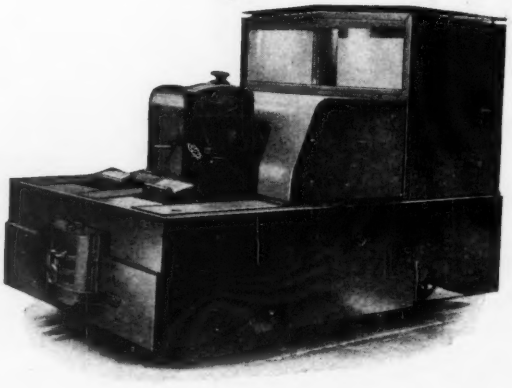

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Italy

THE progress of the natural gas industry dominated the Italian mining industry in 1953 as it has done in all recent years. But open recognition of this fact was made in November when a Bill was introduced amending the mining laws which had been rendered obsolete because of the tremendous development of natural gas. The discovery of this cheap fuel has, in fact, completely reshaped the future for Italian industry and it is estimated that by 1958 40 per cent of Italian power consumption will be met by natural gas.

Further large scale discoveries of natural gas might, however, spell the end of the other great State-subsidized mining operation, the Sardinia Sulcis mine, which is also threatened by the Coal and Steel Community because of its subsidies.

MINERAL OUTPUT

(in thousands of metric tons)

	1952	1953†		1952	1953†
Bauxite	239.3	**224.7**	Barytes	46.2	**58.3**
Antimony and arsenic ores	7.8	**4.9**	Feldspar	21.4	**18.8**
			Fluorspar ...	48.0	**81.0**
Manganese ores	34.2	**33.5**	Pyrites	939.7	**1,020.6**
Mercury ores ..	152.4	**161.4**	Petroleum ..	48.9	**71.9**
Lead ores	53.9	**55.3**	Natural gas*	1,117.6	**1,832.4**
Zinc ores	196.3	**177.6**	Coal	931.8	**961.8**
Asbestos	20.3	**16.9**	Brown coal .	713.4	**655.2**

* In millions of cubic metres. † January-October only.

Lead and zinc mining enjoyed a reasonably successful year although falling prices made production difficult for some mines. About 93 per cent of lead ore and 80 per cent of zinc ore comes from Sardinia. Zinc production reached a record rate in 1953 but domestic lead ores are far from adequate to keep the smelting plants at capacity.

The big Montevecchio deposits produce annually about 36,000 tons of blende containing 60 per cent zinc and 75,000 tons of galena containing 65 per cent lead.

Lead is also mined at Monteponi, Ingortusa, Gennamari, San Siovanni, Malfidano and at the State owned mines of Raibl and Monte Neve. There are three large lead smelters, San Garvino, Monreali and Monteponi in Sardinia, and one at Pertusola in Liguria. There are two large lead refining plants at Milan and eight smaller at Milan, Florence, Turin and Naples.

Zinc is mined in Sardinia and at Oreta, Premola, Dassena and Camerata Cornella. Electrolytic zinc is produced at Porto Marghera, Crotoni and Monteponi, and the thermal reduction process is used at Vado Ligure. At the Porto Marghera refinery a fractional distillation process produces a zinc of 99.999 per cent purity. There are varying percentages of silver in the lead galena and of cadmium in the blende. Pre-war cadmium output from Porto Marghera, Monteponi and Crotone was 5 per cent of the world total.

Mercury producers found that 1953 was better than expected, thanks to large orders for the American stockpile.

Italy is (after Russia) the most important European producer of asbestos, mostly from the Belangero mine. She is also one of the most important world producers of talc.

Manganese is obtained from Liguria, Sardinia and Elba ; of the three main processers those at Genoa and Breno use the alumina-thermic process and at Milan the electrolytic.

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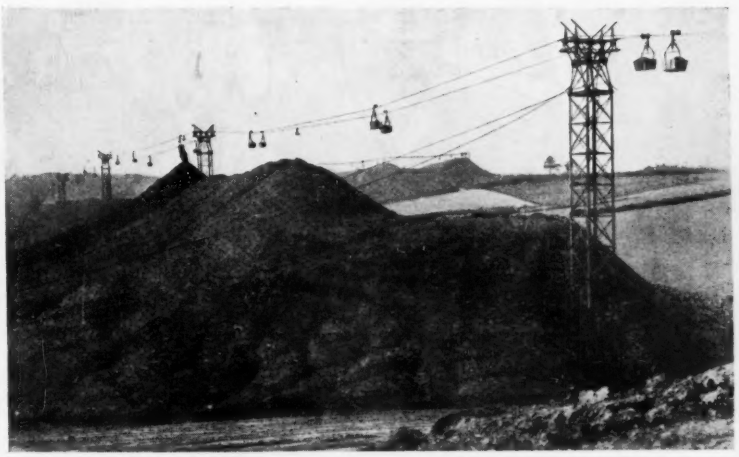

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Spain *By Our Own Correspondent*

THE broad picture of mining operations in Spain during 1953 closely resembled that of the previous year. Coal mining exhibited the chief improvement with a total of 13,948,436 tonnes (bituminous 10,209,719, anthracite 1,945,850, and brown coal 1,792,667), as compared with 13,632,943 tonnes in 1952. Statistics of imports are not yet available, but the total for the year is not likely to show much change over imports for 1952, at approximately 1,100,000 tonnes.

Output of pyrites (crude, washed and flotation concentrates) totalled 2,079,842 tonnes, a slight reduction on the 2,150,684 tonnes of the previous year. Potash, on the other hand, showed an improvement at 172,278 tonnes against 164,171 in the previous year. Other earthy ores, however, were generally lower: magnesite 11,000 tonnes against 15,138; fluorspar 107,129 tonnes compared with 125,418, graphite 270 tonnes compared with 443; while bauxite, felspar, quartz and pyrites barely maintained their previous figures. Exceptionally kaolin improved to 20,079 tonnes compared with 15,617 tonnes in 1952.

Improved Lead Production

The steady effort to improve lead production in recent years achieved marked success in 1953. The production of marketable lead rose to 54,784 tonnes (from 85,794 tonnes of ore) as compared with 43,152 tonnes in 1952. The amount of silver extracted likewise improved to 34,498 kilos as compared with 25,365 kilos. Work in the tunnels of Linares, Cartagena, and Almagrera, and other development work showed steady progress. Unfortunately the international lead market did not inspire confidence, but development work is being sustained by the conviction of a sound future for this metal.

Zinc production, though showing some advance, is more or less in step with the 1952 returns. The output of blende was 114,356 tonnes against 104,625 tonnes; of zinc metal 22,926 against 21,250. Cadmium, however, showed a marked increase stimulated by the significant new uses of the metal in nuclear requirements, the total having risen to 7,350 kilos against 4,800 kilos. A considerable portion of production of zinc blende was exported, 39,358 tonnes of crude going to France and America, and 15,371 tonnes of calcined material to Norway and France.

Reduced Wolfram Output

The heavy decline in the price of wolfram was reflected in the output which amounted to 1,539 tonnes compared with 2,736 tonnes in 1952, and further reduction may be expected with the termination or cancellation of the high price contracts of 1951.

Production of tin concentrates amounted to about 1,200 tonnes last year, in addition to which some mixed tin and wolfram ores were produced. Output of tin metal amounted to approximately 825 l.tons.

The iron and steel industry showed improvement with an ingot output of 787,000 tonnes (762,301 in 1952), and of steel 900,000 tonnes (898,225 the previous year). The well-known Wargner field belonging to the Siderurgica de Ponferrada yielded large tonnages of iron ore.

Manganese ore improved to 34,504 tonnes compared with 29,485 tonnes in the previous year, and ilmenite rose to 1,601 tonnes compared with 1,345 tonnes.

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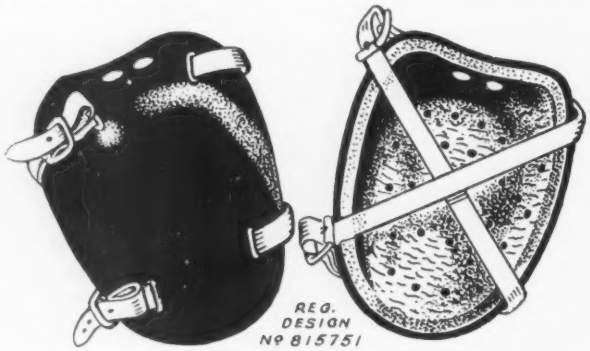

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Portugal

By Our Own Correspondent

THE numerous and ever increasing difficulties with which producers in Portugal are contending were still further accentuated by the catastrophic slide in prices of tungsten ore which occurred at the end of July, 1953.

The Tungsten Industry

Early in July the export tax of Esc. 40 per kilo of concentrate was replaced by an *ad valorem* tax based on the price per kilo as shown on the contract, less 30, the result being multiplied by .45. This reduction would have been helpful had there been any normal trade, but in the existing circumstances the only effect was that exporters holding long-term contracts at high prices and selling high-grade ore paid more than they did before. All shipments made after July appear to have been either under long-term contracts or in the nature of panic sales. Confirmation of this view is afforded by the fact that almost 2,200 tonnes out of the year's total exports of 3,870 tonnes were shipped in the period August-December. Reputedly, consumer countries were showing no interest in tungsten, but whenever a bargain was offered a revival of interest was immediately noticeable.

Exports of tungsten ore averaged about 323 tonnes monthly. The peak month was December when shipments amounted to 699 tonnes, of which roughly a third went to the United Kingdom and the balance to the U.S. These two countries are the only buyers left, for the Continental market—as in the case of cassiterite—has been lost.

It is hoped that a more realistic policy will be adopted by the Ministry of Economy towards tungsten ore exporters; otherwise this industry can be written off, for the steep decline in wolfram prices has made it practically impossible for the small and medium-size mines to continue in operation. It is worth mentioning that Spain, whose production and shipments are normally far below those of Portugal, is now well ahead in exports.

With export taxes approaching £100 per tonne, a steep fall in prices, higher treatment charges, and a tendency to tighten up on quality in consuming countries, it is not surprising that there has been a heavy drop in shipments of cassiterite as compared with 1952. The U.S. purchased 909 tonnes and was the largest market in 1953. Other purchasers included the U.K. (188 tonnes) and Canada (16 tonnes).

Mineral Exports in 1953

Exports of all mineral products declined last year. No records are available in regard to tantalite-columbite, small parcels of which have, however, been shipped to the United States.

Principal mineral exports for the year (in tonnes) were: tungsten 3,870 (4,495); cassiterite 1,113 (1,654); cupreous pyrites 304,864 (412,832); roasted and leached pyrites 143,301 (323,157); manganese 14,171 (4,138); iron ore 116,073 (25,000); white arsenic 1,158 (1,219); and tin metals 45,000 kilos (238,000 kilos).

It is said that the indifference shown in high quarters towards the mining industry is due to a desire to keep workers on the land and not allow agriculture to suffer from a shortage of labour caused by higher wages in the mining industry. Since agriculture is in much the same position as mining, however, it is unlikely to benefit greatly from such a policy.

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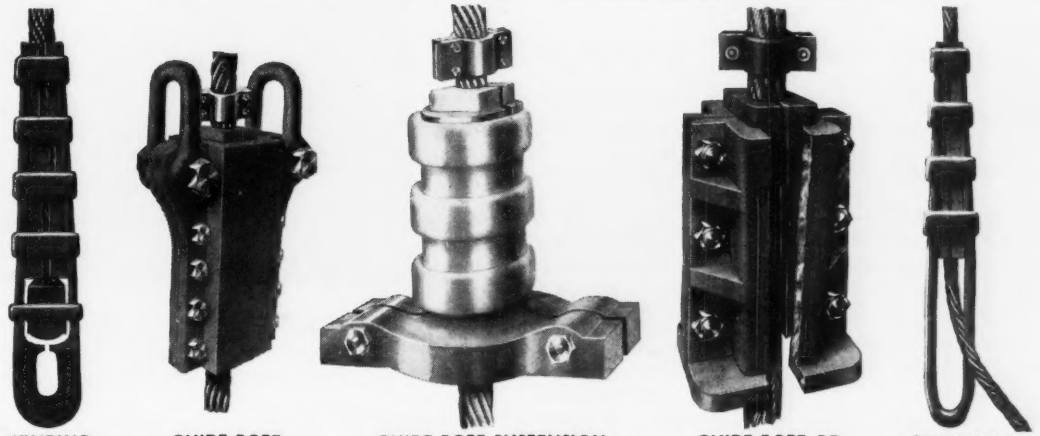

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France

FRANCE and her Empire have not previously featured in this *Review*. Data is not readily available, and there may well be unintentional omissions, if not distortions of fact, in the notes which follow.

The Non-Ferrous Industry in Metropolitan France

Great efforts are being made in France to develop atomic power and small but regular deposits of uranium-bearing ore have been obtained, particularly from La Crouzill.

Preparations are in hand for the celebration in 1954 of the centenary of the first industrial production of aluminium. The chief worked deposits of bauxite are in the Var (yields 80 per cent) and Herault regions. Most of the mineral is obtained from open quarries, but shallow shafts are sometimes necessary. 1953 was the first year to have the benefit of the 90,000 ampere electrolytic cell of Pechiney, the biggest producer. Both aluminium producers also make magnesium electrolytically.

Zinc ore is mined in France on a substantial scale though there is heavy dependence on the North African territories. Most of the smelters are in the Pas-de-Calais-Nord basin, but the biggest, producing half the total output electrolytically, is at Viviez.

Lead is smelted chiefly in the Pas de Calais but there is another smelter at l'Estaque which serves the five mines around Marseilles, all of which have flotation plants. Of the group only Loubatière seems to have a promising future. Orb, Malines and Croix de Pallières are all extremely marginal producers (Orb was also a gold producer) and because of exhaustion or high extraction costs are dependent on a lead price substantially above the present level.

Cobalt is produced from Moroccan ores. The ore is heated in l'Estaque and the speiss reduced to metal at Plombières.

METAL AND MINERAL OUTPUT
(All in metric tons)

	1952	1953
Metropolitan France	(000)	(000)
Crude oil	353	**366**
Natural gas†	266,000	**243,000**
Coal and lignite	57,355	**54,526**
Iron ore	40,716	**42,368**
Pyrites	294	**298**
Aluminium	108	**136**
Zinc	93	**95**
Tin	7.9	**7.9**
Copper (electrolytic)	16.7	**16.6**
Lead	71	**74**
Morocco		
Coal	460	***463**
Manganese ore	383	***327**
Lead ore	115	***91**
Zinc ore	52	***54**
Iron ore	650	***455**
Cobalt ore	9.1	***5.3**
Algeria		
Coal	269	**290**
Iron ore	3,086	**3,380**
Iron pyrites	24	**30**
Lead ore	6.5	**10**
Zinc ore	25	**30**
Tunisia		
Iron ore	977	**1,057**
Lead ore	37	**38**
Zinc ore	7.5	**6.6**

† Cubic metres. * 10 months only.

French North Africa

Morocco continued to be the French Union's most important source of lead and zinc ores, Zelidja, Toussit and Aouli being the largest lead mines, and Zelidja largest zinc mine.

The most interesting activity in Morocco, however, was the prospecting for a wide range of ores. Intensive prospecting for antimony was pressed forward at the Si M'Bark, M'Guedh and M'Rist mines with apparently good results. The Bureau de Recherche et de participations Minières have been prospecting for copper in the region of Bou-Skour and in the Tozi N'Test mountain range. There has been prospecting for tungsten around Hassian el Diab and Culmer, but Azegour is still the only producer.

Reorganization for bigger output has been made at Bou-Azzer, the sole cobalt producer. Ait Amar continues to produce about 80 per cent of Moroccan iron ore.

In *Algeria* an iron ore deposit estimated at about 80,000,000 tons was discovered near Tindouf having 50-55 per cent Fe and .02-.04 per cent phosphorus. There is no news of any decision to exploit it and the deposit is very inaccessible.

Tunisia is second only to Morocco as a source of lead, the principal mines being El Grefa, Djebel Semene Sidi Bou Aouane, Djebel Hallouf, Resses Touiref, Sidi Amar ; Sakiet Sidi Youssif and Djebel Ressas were the chief zinc sources.

1953 saw the first full year's operation of the pneumatic washing plant at the Imini manganese mine which permits low-grade ores to be handled. Most of the big mines, with the exception of Bou-Arfa, are in the High Atlas and thus transport costs are heavy. The Zat overhead railway was opened in 1953 but its use is reserved to Tifrout Tiranimim and Imini mines.

Cameroons

Prospecting has taken place for molybdenum in the Mungo region. Tungsten production has been much encouraged by the law of 1952 exempting mined minerals from the *ad valorem* tax for three years and limiting the circumstances of its future application.

Rutile is also being produced increasingly ; it is found in mica schists and in quartz veins, especially around Yaoundi, and is exploited by placer methods. The rutile is of high grade, 98 per cent TiO_2 with a silica content of 1 per cent.

French Equatorial Africa

An agreement was reached for a joint Franco-American exploitation of manganese in Gabon in 1953.

Still showing great vigour is the diamond industry, the output of which has doubled since 1945. Diamonds exist mostly as detrital deposits. The most important source is the Western Ubangi. Exploration is going on in the same region and along the valleys of the Mambure, the Sangha and the Lobaye. The M'Fouati mine was the only source of lead and zinc during the year.

French West Africa

Reports of American interest in manganese ore have continued to come in. There is now a modern plant at Djifere-Sangomar for treating beach deposits of ilmenite. Underwater deposits are tapped by dragging operations. Gold production continued to decline.

Madagascar

Appreciable deposits of uranium ore have now been detected and the island is an important source. Columbite is obtained as a by-product of beryllium, which is found mostly at Anpandramaika and Malakialina.

New Caledonia

Chromite and manganese ore are both mined in quantity. New operations began in 1953 for the exploitation of manganese near Voh. New Caledonia also supplies nickel ore to France's sole nickel producer.

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Germany

COAL and steel, the traditional props of the German economy, had an indifferent year in 1953, a time when other industries were still breaking records. Germany increased her exports of coal to member countries of the Coal and Steel Community by 12.5 per cent (by comparison Belgium increased hers by more than 50 per cent) and with more investment capital the industry should have a prosperous future, although Germany has, since the war, become an appreciable oil producer.

The steel industry, on the other hand, has a more unsettled future—competition is stiffening within the Community, while the industry is in dispute with the High Authority on export pricing policy and in general finding itself unable and in some ways unwilling to alter its trading practices.

MINERAL OUTPUT
(in metric tons)

	1952 (000)	1953 (000)
Coal	123,276	**124,476**
Lignite	82,364	**84,552**
Iron ore (Fe content)	4,182	**3,888**
Crude oil	1,755	**2,189**
Electrolytic copper*	194	**211**
Lead*	139	**147**
Zinc*	147	**148**
Aluminium	98	**107**

* Source: A.B.M.S. smelter bases.

The lead and zinc industries have also benefited substantially from heavy investment in the past two to three years. Zinc and lead ores are found mostly in Upper Silesia, the Harz mountains, the Rhineland and to a limited extent in Saxony and Southern Germany. Unterharzer Berg und Huettenwerke produces zinc and lead sulphide ores from the Rammesburg deposits. The ores average 19 per cent zinc and 9 per cent lead, they are concentrated by flotation and processed at adjoining smelters.

On the right bank of the Rhine there are lead and zinc ores (few of which are, in fact, worked). At Ems one deposit produces zinc blende and lead galena. In the Bergische Land area, only at Luederich and Nikolaus-Pheonix is there much activity.

Zinc and lead mining is becoming much more important in the Ruhr where the ores average 4 per cent lead and 7 per cent zinc; a preliminary flotation is required to get rid of the anthracite.

On the left bank of the Rhine the deposits are much poorer, except at Mechernich, the Eifel mountains and at Maubach. Near Maubach there are ores containing about 1,760,000 tons of lead. In the upper Eifel, the lead sulphide and lead carbonate ores containing some copper, silver and antimony, yield lead of 99.995 per cent purity. There are three lead-zinc ore districts in South Germany and galena and zinc blende in the Black Forest mountains.

In the aluminium industry the important developments are still the restoration of dismantled plants. A new potline at the Vereinigte Aluminium Werke at Luenen started up late in 1952 and has substantially increased output.

Although only Duisberger Kuepferhuette is producing cobalt the take off has been slow because of the size of industrial stocks. In November, Professor Werner-Heisenburg, Director of Atomic Research during the war, said preparations were in hand to mine uranium. Uranium occurs in the Black Forest and in the Fichtel mountains.

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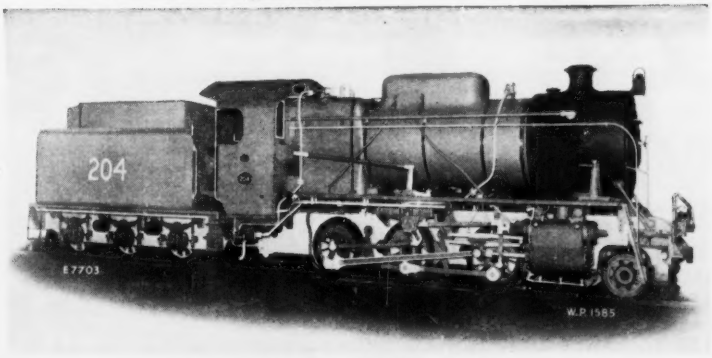

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Norway

THE main feature in Norwegian ore mining in 1953 was the coming into full production of the Sydvaranger mine, which alone yielded 830,000 tonnes of iron ore concentrates, making 70 per cent of the tonnage total, and worth about 35 per cent of the total ore production of Norway in value. In 1953 Norway had 21 main producing mining companies.

Mineral Production

Estimates of total production in tonnes are as follows :

Cupreous and non-cupreous pyrites	740,000	Iron ore and conc.	1,170,000
Copper concentrates	24,000	Ilmenite concentrates	100,000
Zinc concentrates	9,000	Molybdenite conc.	250
Lead concentrates	900	Silver ore (crude)	8,000
		Graphite concentrates	3,000

The total value of the ore and concentrate production can be calculated at around Kr.225,000,000 (£10,250,000). About 300,000 tonnes of pyrites were treated in the Orkla-Metal works at Thamshavn, yielding 103,000 tonnes of native sulphur of which 65,876 tonnes were exported, besides 13,200 tonnes of rich copper matte. About 17,500 tonnes of copper ore concentrates were smelted to yield 3,800 tonnes of bessemer copper in the Sulitjelma and Röros works. All the silver ore was mined and treated at the State owned Kongsberg mine, yielding above 3,000 kg. of fine silver.

Imports of zinc concentrates totalled 48,652 tonnes and 30,876 tonnes of metal were exported. Exports of nickel and its alloys were 14,620 tonnes.

Ferro-alloys

An important section of this trade concerns the ferro-alloys, shipments of which were generally lower. The export of ferro-manganese was 11,765 tonnes as against 84,828 tonnes in 1952 ; imports of manganese ore were also lower at 218,996 tonnes as against 253,163 tonnes the previous year. Ferro-chrome exports were 14,522 tonnes against 19,726 tonnes in 1952 ; imports of chromite were also lower at 48,076 tonnes compared with 50,514 tonnes a year earlier. Ferro-silicon shipments showed little change at 55,969 tonnes against 55,614. Exports of ferro-silicon manganese were 11,765 tonnes against 18,083.

In the chemical industry exports of calcium carbide rose from 17,533 tonnes to 18,284 tonnes. Nitrate of ammonia exports declined from 670 tonnes to 166 tonnes. Cyanimide products rose from 17,344 tonnes to 26,922 tonnes. Imports of cryolite were slightly reduced at 5,457 tonnes compared with 5,579 in the previous year. Imports of bauxite were almost halved at 20,659 tonnes, though aluminium exports rose to 48,579. Construction of the new Sundalsorva plant, planned to produce 40,000 tonnes p.a., has made good progress, and may start up this year.

Copper Developments

Imports of raw copper were 14,245 tonnes and exports 11,024. Prospecting was carried out by Folldal Verk, Grimsdal, and the deposits have been computed to contain 1,000,000 tonnes of ore. Finds at Soendre Geitryggen. however, have been scaled down to 400,000 tonnes of ore. Geophysical observations suggest the presence of other deposits in the vicinity. During the year the Boliden Company of Sweden sought the grant of an extensive concession over 1,000 sq. kilometres around Kautokeino in the Finnmark highlands; with the condition that the concentrates be smelted in Sweden. The concession still awaits acceptance by the Norwegian Government.

Sweden

THE mining industry in Sweden made further progress during 1953. Exploration was vigorously carried on and continued to give encouraging results. With the exception of pyrites, production of all the principal minerals was substantially higher.

Mechanization and Prospecting

Mechanization in underground mining made further advances. On each new level chutes are mechanized, larger transport units are being put into service, and coarse crushers are being installed below ground. Increasing use is being made of short delay blasting and of percussive drills for deep holes. For drilling small-diameter holes ¾ in. and 1 in. drill steels with integral tungsten carbide-tipped bits are invariably employed. When collaring in narrow stopes flexible flat-bar or jointed drill rods are employed.

Prospectors have been active in both the iron ore and sulphide ore areas. Some of the many indications obtained from geophysical measurements made from aeroplanes in 1952 have already been investigated. As a result, a number of additional small deposits have been discovered, largely in conjunction with orebodies already known.

In central Sweden operations have started at the Stromhäg mine in Uppland, where a small deposit of iron ore containing barium is being worked. At Norberg it is planned to drive a central hoisting shaft for mines belonging to the Norbergs Grufförvaltning. Development operations are in progress at Forsbo in Delecarlia, where a deposit of iron ore was recently discovered. This mine belongs to the Ställberg company, which is opening up a deposit on the island of Utö containing both iron and lead-zinc ores. Last year Ställberg erected a new hoisting plant in its Idkerberget mine near Ludvika. A mine hoist is being installed at S.K.F.'s newly discovered iron ore deposit at Vingesbacke, near Hofors. The Stora Kopparbergs Bergslags AB. has erected a mine plant at Blötberget, near Ludvika, which has now reached its estimated production of 20,000 tons a year. The Fagersta Bruk has a new concentration plant in course of erection at Rudgruven, Fagersta.

At Persberg, in the province of Värmland, a new sponge iron works is nearing completion. The Grangesbergsbolaget (T.G.O.) is building a plant at Oxelösund with an annual capacity of 30,000 tons of sponge iron. At its Kiruna mine in Lapland (L.K.A.B.), the same company is preparing to change to underground working. Eight new shafts have already been driven. At its Malmberget mine new plants for treating both Malmberget and Koskullskulle ores are being enlarged. Ore will be brought from Malmberget by conveyor and a transport tunnel from Koskullskulle has already been completed. The hoisting plants are being extended to handle 12,000,000 tons of broken ore a year at Kiruna and 4,000,000-5,000,000 tons at Malmberget.

Expansion at Kiruna and Boliden

The production capacity of the Toulluvaara mine near Kiruna has been raised by modernization to 300,000-400,000 tons of ore annually. A new central works for the flotation of sulphide ores has been opened at Boliden by the Boliden Company and a shaft house 72 m. high has been put into commission. The transport drift leading to the new works from the Längsele mine, 5 km. west of Boliden, is 1,500 m. long and is 400 m. below the surface. At Rudtjebäcken, in Mala, owned by the State and operated by the Boliden Company, a new shaft house is being erected.

The AB. Zinkgruvor's new plant at Garpenberg, Central Sweden, with its shaft house 74.5 m. high, is now hoisting 900 tons a day for the new lead and zinc flotation works.

Cornwall

By F. B. MICHELL, B.Sc., A.C.S.M., M.I.M.M.

DURING the year there has been no expansion whatever in Cornish mining, and on the contrary, three smaller producers have suspended operations owing to the fall in the prices of tin and tungsten earlier in the year.

As far as the two major producers are concerned, the annual report for Geevor Tin Mines Ltd. published in August and covering the 12 months ending March 31, 1953, showed an operating profit of £115,462 (on which a 45 per cent dividend was paid) compared with £222,825 for the previous year.

This lower profit was due to the falling tin price and a lower production, coupled with some increase in stores and wages. Development footage amounted to 6,702 ft., an increase of 681 ft. over the previous year. Total ore milled amounted to 57,368 tons and yielded 600 tons of tin concentrate, being a recovery of 24.43 lb. of black tin (65 per cent) per ton milled. Production of tin for the calendar year 1953 amounted to 680 tons of concentrate.

At South Crofty Mine the report for the calendar year 1952, published last July, showed an operational profit of £46,618, a 10 per cent dividend being paid. For the calendar year 1953 some 555½ tons of tin concentrate were produced compared with 475 tons in the previous year. Work on the new pump installation is now nearing completion and development has been started again during the year on the complex lode.

Towards the end of last year the directors of New Consols Mine decided to abandon their property and early in the year the pumps were withdrawn.

Work at Trebartha continued for some time, as a joint venture of the London and Scandinavian Metallurgical Co. Ltd., New Consols Mines Ltd. and Campbell, Gifford and Morton Ltd., but late in the year it was decided to put the mine on a care and maintenance basis as from January 1, 1954, owing to the decline in prices. Over the past two years a considerable amount of development was carried out and some 10,000 tons of ore exposed, whilst during 1953 3,500 tons of ore have been milled at the New Consols plant on a customs basis.

An adjoining mine operated by the Hawkeswood Mining Co. has been carrying out development on a wolfram lode for some time and a small concentrating plant is now being erected.

Operations by the British Malayan Tin Syndicate continued throughout the greater part of the year at their Basset plant, treating residues from mines in that area. Up to last April the concentrator was stated to be working at a reasonable profit, but commenced to show a loss in May and the plant is now idle.

Minerals Recovery Ltd. have continued to operate their plant at Kieve mill near Camborne where tin bearing beach sand transported from the Gwithian-Hayle area is treated. The grade of this sand varies considerably, but sometimes the value approaches 1 per cent of tin.

DEVON

In Devon, apart from the china clay production of Lea Moor pit near Plymouth, where building sand as well as other by-product minerals are separated, mining is on a small scale and is restricted to barite mining at the Bridford mine, Christow, now owned by Laporte Chemicals, certain ball clay mines in the Bovey Basin, the Bridford Black mine, and the small but probably unique micaceous haematite mine at Hennock, near Newton Abbot, which supplies the special micaceous oxide used in protective paints on steel bridges and other structures.

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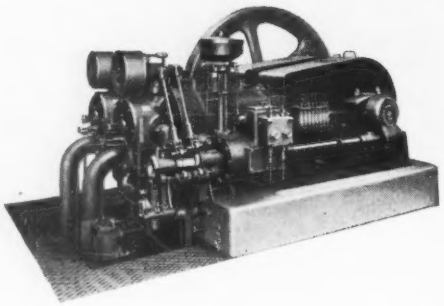

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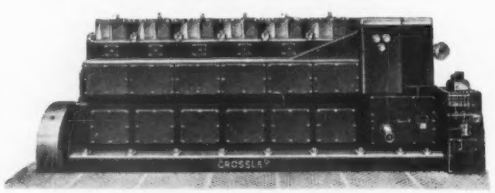

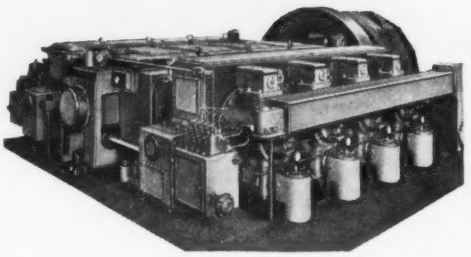

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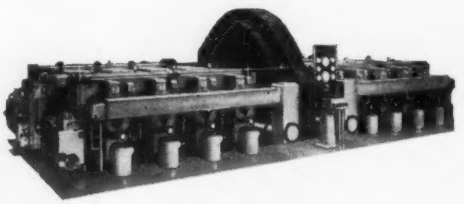

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Mining in Great Britain

By J. B. RICHARDSON, A.R.S.M., M.I.M.M.

THE outstanding event for mining in this country (outside of coal and iron mining, which are discussed on pages 52 and 32) has been the decision to form the United Kingdom Metal Mining Association to represent the interests of the non-ferrous metal mining industry in all parts of the country. It is the first time that such a mine owners' association has been created, although producers of black tin from time immemorial and more recently the fluorspar and barytes producers have had their own association for various purposes. The new body will form the negotiating channel for putting forward the views and problems of the industry to governmental authorities both central and local, doing for British mines at home what the British Overseas Mining Association has for over a decade been seeking to do for British mines abroad.

Mr. Taylor's Initiative

Appropriately Mr. Sydney Taylor, head of John Taylor and Sons, the prime mover in this matter, is the first chairman. His family firm for very many years in the heyday of British mining, vigorously mined tin, copper, lead and zinc in many parts of England and Wales. The headquarters of the concern are at 2 White Lion Court, Cornhill, London, E.C.2.

It has been said repeatedly that no Chancellor of whatever party will have the courage to take the risk of introducing financial legislation in favour of a particular industry. Logically, therefore, every Chancellor of the Exchequer should seek to amend legislation that discriminates *against* any particular industry and there can be no doubt whatever that this small primary industry, which U.K.M.M.A. represents, is being unfairly handicapped by crippling taxation which prevents any real revival of its former importance—when the nature of its short-lived wasting assets is taken into account.

The new body will have many hard problems to solve, both national and local, and readers of this Journal will surely all wish every success to this new David in its struggle with the Goliath of taxation and discrimination.

The joint venture of Johannesburg Consolidated Investment and Derbyshire Stone near Matlock, during the year, cut a 10 per cent lead vein in the crosscut from the new shaft it put down. The former's Parc mine at Llanwrst in the Conway Valley continues to produce lead and zinc concentrates, which are smelted in this country at Chester and Avonmouth respectively. Halkyn have recently devoted more attention to development by driving south on their sea-level tunnel so that grade of ore to the mill has suffered a little but they have been duly rewarded quite recently by cutting a good new lode. Their sea-level tunnel acts as their main drain, their main haulage road, and is their life-line in the search for fresh ore. They also produce a large tonnage of high-grade agricultural limestone from underground quarrying. Greenside continue to work a 20 ft. orebody.

In Scotland at Wanlockhead (the joint venture of Rio Tinto and Siamese Tin) the mine is dewatered down to the 160 fathom level and they are busy sampling the many old workings.

Progress in Cornwall and Devon is discussed separately on page 187. The notes which follow record progress in the rest of Britain.

In the North Pennines, Cow Green mine has just closed down after working for 19 years and it is understood that it is to be allowed to fill with water to the Horse level. Nentsbury mine, Haggs Level, near Nenthead, recently also shut down after being re-opened only a short time ago for zinc ore. It formerly produced much lead and zinc ore for the Vieille Montaigne Company. Cammock Eels mine, two miles east of Westgate in Weardale, which was opened up for fluorspar in 1948, is in production, the ore being treated at the modern flotation plant at Nenthead, near Alston, to produce chemical grade fluorspar. All these properties are operated by the Anglo-Austral group.

Blackdene mine, Weardale, belonging to United Steel, has recently installed an up-to-date gravity plant for concentrating fluorspar for steelworks. The Weardale Lead Company, besides operating Stetfield Burn and Wolfcleugh, near Rookhope, have recently taken over the Barbary mine which is said to contain high-grade fluorspar and is now being dewatered. Stanhopeburn mine, near Stanhope, recently undertook development in depth and the results are reported to be good. All the ore is now treated in the flotation plant at the mine to make chemical grade fluorspar.

Swinhope mine, worked by the Allendale Metalliferous Mining Company, and whose ore was treated by Durham Chemicals at Birtley, closed down at the end of last summer. Close House mine, situated west of Middleton in Teesdale, operated by Athole G. Allen, Stockton, Ltd., is still in production for barytes, as is also Silverband mine, high up on the west flank of Dun Fell, recently re-opened after four years' closure.

Settlingstone mine, in Northumberland, still continues to produce witherite, which is also produced at Holmside and South Moor Collieries. It is rumoured that Hartside mine, near Alston, is to open up for the production of barytes. Coldberry lead mine, near Middleton, is still producing good grade lead concentrates from their gravity plant, and the prospects are reported to be good.

Difficulties of the Barytes Industry

To the south in Derbyshire the mine at Eyam, near Sheffield, continues to produce chemical grade fluorspar in its modern mill equipped with two sink and float units and flotation plant.

While there is steady progress in the production of chemical grade fluorspar for the chemical and refrigeration industries, the outlook for barytes mining is not so hopeful, but not because of lack of reserves. In the North Pennines there are undoubtedly large reserves of both minerals awaiting exploitation, often with a small amount of lead ore to act as a sweetener. The reason for the gloomy picture for barytes has nothing to do with exhaustion of supplies but is caused by the importation of cheap barytes from Mediterrean countries and North Africa. Here is a problem which might well engage the attention of the new U.K. Metal Mining Association, if this body eventually comes to represent the interest of all the producers of non-metallic, as well as the handful of tin, lead and zinc mines, in order to present as powerful a combined front as possible to the powers that be.

There are a number of projects afoot for opening up and deepening old mines and schemes for the treatment of dumps which could become realities if only the government would give the slightest sign of fostering this strategically important industry because the ancient mining tradition of this island is still very much alive.

LEARNING THE ROPES

The diagram shows the end section of a Locked Coil rope made by British Ropes Limited.

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Colonial Geological Surveys

GEOLOGICAL Surveys have been operating during the year in 21 Colonial territories with a scientific staff of about 200, and the following is a very brief summary of some of their activities. After making allowance for shortage of staff in some territories, and for the emergency conditions in Malaya and Kenya, it is possible to say that satisfactory progress has been made in all branches of Geological Survey work, including geological mapping, the investigation of mineral resources, and in solving the geological problems arising from engineering and water-supply projects.

East Africa

In Kenya, where geologists in common with all departments have been seconded for special duties, geological work has had to be slowed down, but investigation of the Mrima carbonatite complex has continued, and the deposit has been shown to be potentially very important because of its content of niobium and cerium. An examination was begun of Homa Mountain in Western Kenya where also there is a carbonatite centre.

The soils at Sukulu, in Uganda, with their valuable contents of niobium and phosphate, first discovered and prospected by the Geological Survey, are now being examined by a syndicate made up of mining companies and the Uganda Development Corporation. The Uganda Geological Survey is helping the Corporation to prospect other carbonatite centres by using geophysical methods. Pits in one area have shown the presence of widespread vermiculite. The Geological Survey also continued to supervise the development of rural water supplies, in which 20 drills are continuously employed, and tractor-operated reservoir construction units were maintained in the Karamoja, Busoga and Ankole districts.

In Tanganyika a discovery of considerable potential importance is the presence of various carbonatite occurrences with the niobium mineral pyrochlore. Very active work continues also at other mineral prospects and on geological problems concerned with engineering, hydrology, soils and building materials.

Central and Southern Africa

In Northern Rhodesia a considerable amount of sampling was done on a carbonatite occurrence containing pyrochlore rich in niobium at Nkombwa Hill near Isoka. Work also continued on the geological problems involved in the construction of the dam and tunnel for the Kafue Gorge hydro-electric project. The Geological Survey in Nyasaland is collaborating with mining corporations in prospecting carbonatites and also continues with its important part in the development of village water supplies.

In Bechuanaland, in spite of a shortage of staff, in addition to work on water supply various mineral occurrences were investigated, and exploratory drilling for coal was continued. In Swaziland the mining of chrysotile asbestos produced 30,103.7 s.tons during 1953 as compared with the 34,769.2 s.tons of the previous year. There are prospects of increasing this production, and, in less degree, that of tinstone, gold and barytes, and there are possibilities also in calcite, coal, columbite, diaspore, iron ore, kaolin, monazite, pyrophyllite, talc, tantalite and yttrotantalite.

West Africa

In Nigeria geological work and prospecting by drilling have continued in the coal areas and a large reserve tonnage has been proved west of Enugu. The Geological Survey has discovered an extensive deposit of lateritic iron ore near Enugu and a preliminary investigation into the possibility of starting an iron and steel industry is going on. The presence of columbite in the Jos-Bukuru granite was further examined.

In the Gold Coast the Geological Survey has co-operated with the consulting engineers in their planning of the Volta River hydro-electric scheme and of the Tema Harbour project.

In Sierra Leone the work of the Geological Survey has revealed a number of promising mineral prospects and a number of discoveries are now held by mining companies under Exclusive Prospective Licence.

West Indies and Far East

In Malaya, systematic geological mapping has continued in Kelantan, Trengganu, Perak, Selangor and Kedah. Field work was done in Sarawak and North Borneo and reports were published.

In British Guiana a mining company commenced the detailed exploration of the zone of manganiferous rocks discovered by the Geological Survey in the north western district, and a large tonnage of detrital manganese ore has been recorded. Several companies have been examining the columbite-tantalite deposits in the Mazaruni district originally described by the Geological Survey.

In Jamaica operations of companies mining bauxite have commenced and the Geological Survey is helping in the search for other bauxite areas in addition to other minerals. Diamond drilling of the large gypsum deposits is being carried out by the department.

Collaboration from the Universities

The expedition to Mount Kilimanjaro in Tanganyika has evidenced the continued interest maintained by the Universities in the geology and mineral resources of the Colonial territories. A party of four from the University of Sheffield augmented by members of the Tanganyika Geological Survey investigated the fumarolic activity of the mountain, and the condition of its ice cap, which has an influence on climatic and meteorological phenomena in the neighbourhood. They also examined the succession and petrology of the volcanic rocks concerning which a report will be available in due course. The Professor of Geology and the Lecturer in Mineralogy at the University of Durham have spent some weeks in Sierra Leone examining the chromite-bearing serpentines of the Kambui Hills.

Photogeological Section and Mineral Resources Division

During the year the Photogeological Section of the Directorate continued reconnaissance mapping from air photographs of Sarawak and North Borneo, and the officer entrusted with this work is now spending some months in North Borneo checking and extending by field work. A reconnaissance examination was also made of an area in South Tanganyika to enable the planning of future field work. Work was done for Nyasaland and Cyprus. An officer visited the East and Central African territories to co-ordinate the work of the Photogeological Section with the activities of the different Geological Surveys.

The demands upon the services supplied by the Mineral Resources Division continued to increase and additional staff is being appointed. One officer from the Division visited the East and Central African territories in connection with carbonatite investigations. The quarterly bulletin *Colonial Geology and Mineral Resources* was issued as usual.

Progress of Mining Shares on the London Stock Exchange

By Our Stock Exchange Correspondent

THE financial year 1953/54 (the basis for this review) has brought a radical change in the outlook for the U.K. The 1953 Budget aimed to encourage output, and Britain and the Sterling Area have gradually struggled off the lee shore which threatened them in 1951. Many companies will benefit materially from the removal of the Excess Profits Levy which came into effect on January 1. The year was one of great interest. The bank rate was reduced from 4 per cent to 3½ per cent in September and the gold and dollar reserves of the sterling area have gradually increased.

The renewed confidence of the world in the £ was shown by its strength in Continental and other centres. Many of London's traditional markets were restored and, not least of them, the gold market. This occurred just before the end of the period under review, and at the time of going to press there is evidence of considerable broadening of interest.

Last year's hopes of Russian co-operation were dashed, but trade with the East increased and on several occasions settlement in gold made a welcome addition to this country's reserves. In the gilt-edged market the return of corporation borrowing on a significant scale, and the strength of gilt-edged stocks were features.

Kaffirs

Shares in this group began the year badly. Political factors and the gradual disappearance of the premium on gold both had their effect ; in addition, there was the problem of an acute labour shortage although this showed signs of improvement at the turn of the year. After the first nine months, the market brightened up very considerably, and at one time near boom conditions prevailed. This was due to the hopes of more stable conditions and to the great strides in development made by the mines themselves. Ever increasing interest was shown in the uranium bearing properties. Several came into production during the period and production plants were planned at many other properties.

On the Far West Rand new gold producers started up and early figures proved promising. All in all, the output of gold from Rand properties seemed likely to increase rather than to fall in the future. Another interesting factor was the keen competition among finance houses for mining options over the new area in the very Far East Rand. The year closed with buoyant markets in London and Johannesburg.

Orange Free State

This section also began the period in poor shape, but markets revived sharply at the turn of the year and good gains were recorded by nearly all the leading properties. New producers in this section included Western Holdings and Freddies North and South. Here also uranium was very much the centre of interest and those properties named as producers or rumoured to be future producers outstripped their companions. Work on the field continued to make steady progress, but returns from individual mines varied considerably. This was reflected in share prices.

During the year there was naturally considerable speculation in some issues as conflicting development results came to hand, but overall a real advance was made. A warning on the present-day cost of bringing mines into production came with the news that Freddies N and S. would merge.

Diamonds

Diamond shares began the year in the same uneasy style they had shown towards the end of the previous one. Later, an improvement and hardening set in when figures for the sales of stones, both gem and industrial, indicated that the anticipated decline was not on anything like the scale which had been feared. A feature of the sales figures was the increased demand for industrial stones, both for stockpiling and general use. This continued the trend of recent years.

The importance of the investments in gold which had been made by the De Beers group became apparent when the sharp improvement in the Orange Free State market was reflected in the enhanced price of these shares despite the easier trend in diamond sales.

West Africans

West African gold shares had another dull year. Conditions in the market were quiet and turnover small. Occasionally, interest was evinced in one or two of the properties but their developments were, on the whole, disappointing, and falling profits did nothing to encourage investors.

This market is usually influenced by the movements of Ashanti shares and it was probably the declining profits from this mine that affected the market more than anything else.

Western Australians

In this section also conditions were very similar. High labour costs and lower profits discouraged buyers and although there were occasional spurts of activity during the year, the overall picture was one of steady idleness. These mines were, of course, affected by the disappearance of the gold premium price in the same way as other groups.

Miscellaneous Gold

There was little activity in this section. Many of the issues command a rather limited market and it is usually only the specialized investor who is prepared to take an interest. Exceptionally, Cam and Motor continued the excellent development results of the past few years and the shares, while remaining quiet, maintained a firm undertone throughout the year. Among the Indian mines, Ooregum closed down and the property was handed over to Champion Reef for the remaining gold to be extracted.

Coppers

This market began the year rather uneasily due to the knowledge that a free metal market was to be re-established during August. It had been thought that a heavy fall in the metal price might ensue. In the event this did not occur and after some period of time had elapsed share prices recovered sharply. Confidence proved justified when excellent company results were announced later in the year.

Stocks in this market finished the period buoyantly on the strength of the satisfactory outlook. The factors bringing this about were appreciation of the difficulties caused by strikes in Chile, and knowledge that the stocks of metal in that country were not being thrown indiscriminately on the market. Results from developing properties in Rhodesia came in slowly and were not sensational. There was some speculation in these shares during the period.

Lead/Zinc

Lead/zinc producers started the year badly continuing the previous depression. Figures from Consolidated Zinc were not encouraging, and Lake George ceased production during the year. Later there was some revival following metal market movements. Mount Isa developed a widening basis of production with its copper programme and later the mine reported staking uranium claims. Conditions in Burma improved and both Mawchi and Burma Mines started regular production in the second half of the year.

Tin

At the beginning of the year the slump in the metal price caused a sharp fall in Eastern tin shares which, however, cheered up towards the end of 1953 with the great improvement on the metal exchange. Sentiment was helped by the proposals for an International Tin agreement. Nigerians reflected the growing interest of some of the main producers in columbite possibilities. Mines such as Amalgamated Tin, Jantar, and Gold and Base Metal started ambitious development programmes. The American bonus price for the mineral was the driving motive behind this all-out production.

Canadian Shares

Canadian mining issues went through a period of retrenchment. The prices naturally fluctuated in sympathy with New York but here, as elsewhere, the recognition that a slump in base metal prices was not immediately likely caused recovery during the last three months of the year. In this market particularly investors looked towards the future rather than the present. Share prices were greatly helped by the firmness of the Canadian dollar which appreciated against the U.S. dollar. The relaxation of switching regulations during the year helped to iron out unnatural differences in price and to accelerate the decline of the premium on dollar stocks in London. This had practically disappeared by the end of the year. Another restriction to be removed was that on the use of nickel; Canada is the leading producer. Canadian gold mines operated under great difficulties due to the fixed gold price, and the Canadian Government continued to subsidise production.

Miscellaneous

The heavy fall in the price of tungsten during 1953 caused a decline in Beralts but the company was helped by its strong cash position and the closing of marginal mines in other parts of the world. Recently the price has moved up sharply and the share price has varied favourably. Manganese shares continued to be prosperous during the period. Asbestos had a good year. The mineral remained in great demand and the leading companies benefited from the removal of Excess Profits Levy. Exceptionally in this group, Rhodesia Monteleo closed down. Consolidated Murchison fluctuated widely on the great changes in the antimony price. At one time the market for this mineral disappeared altogether.

Wankie Colliery make a large capital issue in order to finance big development plans, but production difficulties remained and there were some labour troubles. For this reason investors remained aloof and the shares had a disappointing year.

Looked at from the financial angle 1953/54 was a heartening year during which much solid ground was gained. The future holds the twin problems of riding American trade recessions and curtailing inflated national expenditure.

HIGH AND LOW PRICES REACHED BY LEADING MINING SHARES DURING 1953

	High	Low
Finance		
African & European	52/-	38/9
Anglo American Corp.	6 7/16	5 5/16
Anglo-French	20/4½	16/6
Anglo Transvaal Cons.	28/9	17/4½
Central Mining (£1 shs)	37/6	25/9
Consolidated Goldf'lds	54/1½	43/-
Consol. Mines Select	31/10½	22/3
East Rand Consols	4/6	2/1½
General Mining	104/-	61/3
H.E. Prop.	46/9	29/9
Henderson's Transvaal	9/10½	6/9
Johnnies	71/-	42/6
Rand Mines	93/9	60/-
Rand Selection	38/9	28/1½
Union Corporation	33/9	24/-
Vereeniging Estates	82/6	71/6
Writs	36/-	29/-
West Wits.	49/1½	37/6
Rand Gold		
Blyvoors	45/3	34/-
Brakpan	16/3	8/3
City Deep	33/2	13/8
Consol. Main Reef	34/9	14/3
Crown	41/10½	29/3
Daggas	81/6	64/4½
Dominion Reefs	16/6	6/9
Doornfontein	29/4½	19/6
Durban Deep	55/-	31/10½
E. Daggas	23/-	12/3
E. Geduld (4s. units)	41/3	26/3
E. Rand Props.	75/7½	42/6
Geduld	5½	72/6
Govt. Areas	16/6	11/-
Grootvlei	30/-	18/9
Libanon	13/7½	8/-
Luipaards Vlei	29/10½	19/9
Marievale	23/6	16/-
Modderfontein East	21/3	13/1½
New Kleinfontein	28/-	14/4½
New Pioneer	25/9	13/3
Randfontein	70/9	26/9
Robinson Deep	12/3	9/3
Rose Deep	13/10½	11/9
Simmer & Jack	6/7½	4/-
S.A. Lands	33/-	18/3
Springs	8/-	3/6
Stilfontein	29/10½	22/9
Sub Nigel	56/6	37/6
Van Dyk	12/1½	3/9
Venterspost	17/9	11/7½
Vlakfontein	18/9	11/9
Vogelstruisbult	38/-	29/3
West Driefontein	7 1/16	5 1/16
W. Rand Consolidated	61/3	48/-
Western Reefs	57/-	42/6
O.F.S. Gold		
Freddies	16/3	7/-
Freddies N.	16/3	7/7
Freddies S.	16/6	6/7
F.S. Geduld	64/9	43/6
Geoffries	21/1	11/3
Harmony	28/-	19/3
Loraine	11/1	5/9
Lydenburg Estates	14/9	8/4
Merriespruit	9/3	4/10
Middle Wits	20/1	11/5
Ofsits	45/3	31/-
President Brand	30/9	18/3
President Steyn	26/-	18/9
St. Helena	16/4	11/-
Virginia Ord.	14/10	9/6
Welkom	26/7	14/-
Western Holdings	80/-	68/-
West African Gold		
Amalgamated Banket	2/1	1/1
Ariston	7/3	5/3
Ashanti	28/3	19/-
Bibiani	7/7	4/7
Bremang	2/7	1/9
G.C. Main Reef	4/1	2/9
G.C. Selection Trust	7/9	5/6
Kononga	3/4	1/10
Lyndhurst Deep	1/5	9d.
Marlu	1/7	10d.
Taquah & Abosso	4/5	2/1
Australian Gold		
Boulder Perseverance	2/11	1/9
G.M.s of Kalgoorlie	14/6	10/-
Great Boulder Prop.	10/7	6/9
Lake View & Star	17/7	13/6
Mount Morgan	19/6	16/6
North Kalgurli	7/6	5/8
Sons of Gwalia	8/3	5/3
South Kalgurli	8/3	6/-
Western Mining	13/9	10/6
Miscellaneous Gold		
Cam & Motor	10/-	8/9
Champion Reef	6/6	3/10
Falcon Mines	8/3	6/3
Globe & Phoenix	26/6	20/7
G.F. Rhodesian	6/9	4/3
London & Rhodesian	5/3	4/-
Motapa	2/7	1/1
Mysore	4/3	2/6
Nundydroog	6/4	5/-
Ooregum	4/7	2/4
Oreville	13/7	9/3
St. John d'El Rey	28/6	21/6
Zams	35/9	23/-
Diamonds and Platinum		
Anglo American Inv.	97/6	64/1
Casts	26/9	17/3
Cons. Diam. of S.W.A.	95/-	75/-
De Beers Defd. Bearer	73/9	54/6
De Beers Pfd. Bearer	16⅛	13⅞
Pots Platinum	10/5	6/3
Watervaal	17/3	11/-
Copper		
Chartered	71/6	50/9
Esperanza	7/7	3/-
Indian Copper	4/9	3/6
Messina	86/10	59/4
Nchanga	6 1/16	5 3/16
Rhod. Anglo American	54/3	43/3
Rho-Katanga	16/-	7/3
Rhodesian Selection	18/-	12/3
Rhokana	20⅛	15⅛
Rio Tinto	25⅛	19
Roan Antelope	15/8	11/4
Selection Trust	41/1	24/9
Tanks	65/6	50/6
Tharsis Sulphur Br.	50/-	40/-
Tin (Eastern)		
Ayer Hitam	28/9	20/9
Gopeng	11/7	6/9
Hongkong	10/-	5/-
Ipoh	19/9	12/6
Kamunting	12/10	7/4
Kepong Dredging	7/-	3/10
Kinta Tin Mines	14/6	7/6
Malayan Dredging	28/3	21/6
Pahang	17/4	11/9
Pengkalen	10/6	6/9
Petaling	14/7	7/3
Rambutan	13/9	9/6
Siamese Tin	11/-	7/3
Southern Kinta	16/9	11/9
S. Malayan	28/6	18/4
S. Tronoh	12/10	6/6
Sungei Kinta	19/1	9/-
Tekka Taiping	8/9	3/9
Tronoh	26/9	19/9
Tin (Nigerian and Miscellaneous)		
Amalgamated Tin	12/6	8/3
Beralt Tin	30/1	17/6
Bisichi	5/1	3/4
British Tin Iv.	16/4	11/7
Ex-Lands Nigeria	4/9	3/-
Geevor Tin	15/	8/7
Tin (Nigerian and Miscellaneous) (cont.)		
Gold & Base Metal	4/9	2/5
Jantar Nigeria	9/3	5/8
Jos Tin Area	13/4	10/-
Kaduna Prospectors	3/4	2/-
Kaduna Syndicate	4/-	1/9
London Tin	5/10	4/6
United Tin	3/6	1/9
Silver, Lead, Zinc		
Broken Hill South	46/9	38/6
Burma Corporation	2/6	1/-
Consol. Zinc	28/9	21/7
Lake George	15/6	6/3
Mount Isa	40/6	29/3
New Broken Hill	24/7	17/3
North Broken Hill	60/-	48/-
Rhodesian Broken Hill	14/4	9/6
San Francisco Mines	28/9	16/9
Uruwira	4/2	2/1
Miscellaneous Base Metals and Coal		
Amal. Coll. of S.A.	47/-	41/9
Associated Manganese	56/10	39/3
Cape Asbestos	23/10	17/10
C.P. Manganese	59/6	49/-
Consol. Murchison	36/6	16/9
Mashaba	7d.	2d.
Natal Navigation	63/9	54/-
Turner & Newall	69/4	47/3
Wankie	16/6	10/-
Witbank Colliery	75/3	59/7
Canadian Mines		
International Nickel	$84½	$63½
Mining Corp. of Can.	5 3/16	72/6
Noranda	$144	$112
Quemont	6 1/16	6½
Yukon	4/9	3/6
Oil		
Anglo-Iranian	8 17/32	5 3/16
Apex	49/3	37/-
Attock	37/10	24/-
Burmah	58/10	41/-
Canadian Eagle	36/4	27/-
Mexican Eagle	24/2	20/-
Shell	98/6	75/6
Trinidad Leasehold	17/11	11/6
T.P.D.	26/6	19/8
Ultramar	30/10	20/9

Consolidated Gold Fields of South Africa Ltd.

IN 1887 quite a small company was formed by Cecil Rhodes and his partner, C. D. Rudd, to acquire and develop selected mining properties on the newly discovered gold field of the Rand. From this enterprise originated the Consolidated Gold Fields of South Africa, the oldest of the great South African mining finance houses, whose activities are now virtually world-wide.

In achieving the immediate objectives of its founders, Gold Fields became associated with the development of properties on the Central and Far East Rand, which are among the famous gold mines in the world, but its activities were circumscribed by its memorandum of association. In order to take advantage of the opportunities for extending its interests to other continents and to other fields, a company with a wider memorandum was required. This need was met by the formation in 1919 of New Consolidated Gold Fields whose entire share capital is held by the parent company.

Nearly twenty years ago Gold Fields embarked on an extensive programme of exploration on the Far Western Rand, using the new magnetometric methods of geophysics. The success of these early operations led to the formation of West Witwatersrand Areas Ltd., to take up a large area of ground and embark on a drilling programme. Payable gold-bearing reef was found and to-day there are five large mines operating on what is known as the " West Wits line."

Throughout its long history Gold Fields has gone from strength to strength. Beyond the Rand its interests include South African platinum and coal, base metals in Australia and U.S.A., oil in Venezuela and Trinidad, gold in Southern Rhodesia, East Africa, Canada and Australia. In addition, the company participates in many other mining ventures and is also associated with industrial and commercial undertakings.

Despite the difficulties experienced by the gold mining industry and the fall in base metal profits, Consolidated Gold Fields made a profit of £1,511,000 for the year ended June 30, 1953. Although this was considerably lower than the previous year's profit of £1,996,000, it should be borne in mind that the results for 1951-52 were rather exceptional in that profits enjoyed the assistance of a non-recurring benefit in the form of a credit arising from the company's realization of its entire shareholding in Southern European Metal Corporation which materially helped in raising profits on realization of investments by no less than £680,000 to £1,072,000. The results for 1952-53 were better than those for 1950-51, despite the downward trend of Kaffir dividends. Profit from the realization of investments and sundry revenue amounted to £479,000, a total which was not unsatisfactory having regard to the adverse market conditions which prevailed throughout the year. Dividends and interest on investments at £1,226,000 constituted a further record, thus reflecting the satisfactory development of the company's important interests in the gold mines of the Far West Rand and in the production of platinum.

After charging £635,000 for taxation, the operating company made a net profit of £876,000. With the single exception of 1951-52 this was its highest profit since 1939. After providing £300,000 for depreciation reserve and £100,000 for staff pensions, and also for the preference dividends, the balance available for distribution was £700,075. Despite the contraction in earnings, the company was able to maintain the dividend at 15 per cent. Due to the issue of 300,000 new £1 ordinary shares in March, 1953, this absorbed £371,250 against £330,750 in the previous year, leaving £328,825 to be carried forward.

In the balance sheet of New Consolidated, share capital and reserves totalling £13,199,000 are represented by fixed assets of £447,000, investments totalling £11,383,000, and net current assets of £1,369,000. The balance sheet shows an addition to the net assets of the operating company of approximately £1,909,000, of which £325,000 arises from profits for the year retained by the subsidiaries.

The group assets of New Consolidated and its subsidiary companies were reduced from £21,421,222 to £20,193,043. This was due mainly to a contraction in current assets from £8,749,406 to £7,993,782, with South African Government and bank stocks and U.S. Government stocks standing at £605,855 against £2,716,450 twelve months previously. The holding of tax certificates fell from £285,950 to £143,050 but, on the other hand, cash rose from £2,446,673 to £3,707,198 and call deposits with the National Finance Corporation from £2,091,000 to £2,271,000. Current liabilities stand at £4,697,500 compared with £6,973,149.

ORANGE FREE STATE MINING INTERESTS

Although Gold Fields has taken a less active part in developing the Orange Free State than other South African mining houses, it has large shareholdings in various undertakings engaged in the development of future O.F.S. gold producers. Its portfolio of Free State shares should in due course show capital appreciation and be a source of increasing dividends.

The company has not yet established a mine in the new field but promising results are being obtained by New Consolidated, Free State, Exploration Co., Ltd., which was formed by Gold Fields in 1944 to examine extensive areas under option and to carry out drilling. Through its interest in the farm La Riviera No. 289, the company received a participation in Harmony Gold Mining Co. Ltd. Development on this property has given most encouraging results and the first 45,000 tons per month unit of the reduction plant is expected to go into production during the second half of 1954. Harmony is also a scheduled uranium producer.

New Consolidated, Free State, Exploration Co., Ltd., is at present engaged on a programme of drilling in the Saaiplaas area, where results from boreholes D.S.2 and G.S.I. have further enhanced the prospects for a mine. In view of promising borehole results, the company has exercised its option over the adjacent farm Dirksburg 358. The conditions under which options in this area are held make it desirable that the terms of application for a mining lease should be settled during the current financial year and negotiations to this end are in progress. Considerable further areas over which the mineral rights are owned have still to be investigated.

THE SUB NIGEL LTD.

This historic gold mining company was formed in 1895 and since milling operations commenced in 1909 has crushed 18,772,118 tons of ore for a recovery of 11,337,268 oz. of gold and distributed almost £25,000,000 in dividends to shareholders. To-day, Sub Nigel must be regarded as past its peak, for the yield per ton and ore reserves have gradually been declining.

It will be seen from the table that the throughput was well maintained in 1953 and working costs showed a relatively small increase. The yield declined, however, from 7.0 dwt. to 6.8 dwt., and this was reflected by a fall in the gold production. Despite a reduction of £199,869 in the working profit, the com-

FINANCIAL RESULTS (*for the last two complete financial years.*)

COMPANY	ORDINARY SHARES IN ISSUE	PROFIT AND LOSS RESULTS £(000)										Capital Expenditure† £(000)		LATEST DIVIDENDS DECLARED PER SHARE			
		Working Profit		Premium Revenue		Uranium Profit		Taxation and/or Mining Lease		Net Profit After Tax*				1953		1952	
		1953	1952	1953	1952	1953	1952	1953	1952	1953	1952	1953	1952	June	Dec.	June	Dec.
														s. d.	s. d.	s. d.	s. d.
Libanon§	7,937,300 (10/-)	500·7	433·0	50·0	83·9	——	——	——	——	524·5	502·0	430·1	414·8	3	3	3	3
Luipaards Vlei‡§	4,969,105 (2/-)	568·2	615·2	57·3	98·7	——	——	100·0	160·6	522·3	536·5	62·8	253·0	7½	7½	7	7½
Rietfontein C.	1,122,252 (5/-)	299·6	327·9	12·1	23·9	——	——	140·5	176·7	168·0	171·8	13·7	9·7	1 3	1 4½	1 3	1 4½
Robinson Deep	2,000,000 'B' (7/6)	158·6	145·4	37·2	74·4	——	——	6·9	49·0	189·9	228·1	21·9	40·6	9	9	6	9
Simmer	6,750,000 (2/6)	153·2	190·8	38·8	80·5	——	——	6·4	14·6	201·8	270·4	20·7	35·7	4	4	3	4
Sub Nigel§	1,771,875 (10/-)	1352·2	1501·9	69·8	119·9	——	——	708·2	825·1	738·7	826·7	25·6	29·8	4 0	3 9	4 0	4 0
Venterspost§	4,900,000 (10/-)	726·0	726·9	72·8	113·4	——	——	218·0	224·0	550·8	584·8	361·3	318·9	5	5	6	5
Vlakfontein	6,000,000 (10/-)	864·6	940·4	26·7	55·3	——	——	308·8	410·8	583·4	594·6	345·1	320·4	6½	6½	8	8
Vogels‡	5,028,571 (10/-)	1208·2	1016·6	50·8	82·3	——	——	373·5	417·0	857·8	660·7	47·1	234·7	1 1½	1 1½	1 0	1 0
W. Drie‡§x	7,041,080 (10/-)	2033·0	231·9	58·9	17·1	——	——	139·4	—	1929·3	251·0	1393·0	1833·4	6	9	—	—

* Includes sundry revenue less sundry expenses
† Excluding Capital spent on Uranium production
x 1952 figures for five month period only
‡ Scheduled uranium producer
§ Figures shown are for the years ended June 30, 1952 and 1953 respectively

pany was able to pay dividends totalling 8s. a share compared with 8s. 9d. in 1952. The returns for the last two quarters of 1953 show working profits (including sales of gold at enhanced prices) of £320,215 and £302,811 respectively.

The policy of re-investigating old areas by exploratory stoping and development continues to give satisfactory results but the payable ore disclosed is more erratic in deposition, and consequently it is necessary to include a higher proportion of low grade ore in mining. In view of the disappointing results obtained, development operations in the southern portion of the Eastern Lease Area were discontinued at the beginning of 1953 and the equipment was reclaimed.

ROBINSON DEEP LTD.

Owing to shortages of electric power and labour the throughput for 1953 was 166,000 tons less than that of 1952 and the cost per ton milled was higher by 6s. 3d. Results for the year were greatly improved by an increase in the yield per ton of 0.564 dwt. so that in spite of the lower tonnage milled, the total gold produced showed an increase of 4,833 oz. The improvement in yield more than offset the decrease in gold prices experienced during the year and there was, on balance, a small increase in working revenue of £4,797 over the figures for 1952. Dividends for 1953 amounted to 1s. 6d. as against 1s. 3d. for 1952.

The average grade of ore developed during the year showed a further improvement due primarily to satisfactory disclosures on the Main Reef Leader horizon in the bottom levels of the mine and enhanced the prospects of the new lease area.

The Turf and Chris sub-incline shafts are being deepened in order to carry out development in the new lease area adjoining the southern boundary. Lateral development on level 63 Chris section in this area was started early in 1953 and good progress is being made.

As a result of a particularly heavy movement of ground early in 1952, the No. 2 shaft, Turf section, was put out of commission. This shaft is being reconditioned and when this has been completed the shaft will be sunk a further 1,000 ft. to 10 Level and a waste pass system constructed to enable waste to be hoisted to the surface through this shaft, thus dispensing with the costly reconditioning of No. 2 shaft incline. It will then be possible to recommence development in erosion channel quartzites in the upper levels of the Turf section, from which a substantial additional tonnage is expected.

SIMMER AND JACK MINES, LTD.

This old mine, which started milling in 1888, was able to increase its dividends to 8d. last year compared with 7d. in 1952. Despite the difficulties common to all Rand producers, the milling rate was held at the 1952 level but gold production was 900 oz. higher. Working costs at 37s. 8d. rose only 4d.

Some three years ago a change in mining policy was necessitated by the temporary closing down of the lower Eastern Section owing to ventilation difficulties. Operations in this section were therefore transferred to the old upper areas of the mine. The results obtained from the re-investigation of these old areas have been very gratifying and a large proportion of the tonnage milled is being derived from this source. However, the tonnage produced per foot of development is considerably lower than would be the case when opening up new areas. With improved ventilation conditions in the central area below 53 Level, and with the mining out of this area nearing completion, it has again been found possible to extend operations on a limited scale in the lower levels eastwards beyond the dyke into the eastern section of the mine.

The Western Section of the property is being opened up from the West Sub-Vertical Shaft and a considerable amount of lateral development has now been accomplished but payability at depth in this area and also in the Central and Eastern Sections of the mine has been lower than anticipated. The first stage of a ventilation scheme for the West Sub-Vertical Shaft area is in hand, funds being provided from the reserve.

VOGELSTRUISBULT GOLD MINING AREAS LTD.

Vogelstruisbult was formed in 1933 to work an extensive area on the Far East Rand. This mine is among the scheduled uranium producers and the uranium plant is expected to come into operation towards the last quarter of 1954.

A fourth unit has been added to the reduction plant, making available a rated milling capacity of 100,000 tons per month.

Notable success has been achieved by means of improved tools, mechanization, teamwork and efficient schooling, to improve the tonnage output per native employed. This is evidenced from the very satisfactory results achieved last year, when the reduction plant worked virtually to capacity, working costs were substantially reduced, and the working profit rose by £160,054, although the yield fell by 0.152 dwt. per ton.

LUIPAARDS VLEI ESTATE AND GOLD MINING CO. LTD.

This West Rand producer has also entered into agreement with the Atomic Energy Board to produce uranium, the extraction plant being scheduled for completion in 1954.

Development of the Main and South Reefs at Luipaards Vlei is now being confined mainly to the lower levels of the mine, where the proportion of payable to total footage accomplished is proving to be less than in preceding years. In addition, the value of recent payable development has shown a tendency to decline. It has now become possible to open up the Bird Reef series which have been rendered payable by virtue of their uranium content. Excessive faulting is retarding the rate at which the ore reserve is being built up but encouraging values have been disclosed in reef development and boreholes in widely scattered areas. It has become necessary to improve the ore and waste handling facilities at the Turk shaft. The existing waste pass has been extended and a new loading station in the shaft for waste rock is being excavated. Work is in progress on three new stations and on a separate ore pass system for the handling of ore from the Bird Reef. A hoist to serve the centre compartments of the shaft has been installed. The waste disposal arrangements on the surface are being extended.

An extension to the Turk shaft reduction plant has been completed, bringing the capacity to 110,000 tons per month. When uranium production commences, three units of this plant will be set aside for the separate treatment of Bird Reef ore, the slimes of which will be pumped to the leaching plant for final treatment.

The crushing capacity will be extended to 140,000 tons per month by renovating the sliming section of the old reduction works which, together with the remaining four units of the Turk shaft plant, will continue to treat ore from the South, Battery and Montana Reefs for the extraction of gold.

The more modern layout of reduction operations at Luipaards Vlei should be reflected by lower working costs, while the additional tonnages made available by uranium extraction have greatly improved the future outlook for this old-established but still very vigorous producer.

DEVELOPMENT AND MILLING RESULTS (*for the last two complete financial years*)

COMPANY	TOTAL ORE RESERVES As at last report			DEVELOPMENT RESULTS						MILL THROUGHPUT													
				Ft. Sampled (000)		Payability %		Av. Value (In.-dwt.)**		Tonnage Milled (000)		Cost per Ton		Gold recovered Ounces (000)		Yield (dwt.)		Cost per ounce		Working Profit Per ton		Per oz.	
	Tons (000)	Value (dwt.)	(In.-dwt.)	1953	1952	1953	1952	1953	1952	1953	1952	1953	1952	1953	1952	1953	1952	1953	1952	1953	1952	1953	1952
Libanon§	1,810	4·5	258	25·9	32·5	65	59	327	349	985	955	39/9	38/5	197·5	182·0	4·0	3·8	198/-	201/7	10/2	9/1	50/8	47/7
Luipaards Vlei§‡	2,338	4·4	187	28·0	28·8	59	63	250	285	1,232	1,189	37/5	36/1	231·2	221·6	3·7	3·7	199/7	193/9	9/3	10/4	49/2	55/6
Rietfontein C.	424	5·2	263	9·8	9·2	46	41	360	329	322	325	36/8	35/1	71·9	72·1	4·5	4·4	164/4	158/4	18/7	20/3	83/4	90/11
Robinson Deep	1,351	4·5	233	11·7	11·8	48	51	397	370	1,165	1,331	46/1	39/10	229·1	224·2	3·9	3·4	234/1	236/7	2/9	2/3	13/10	12/11
Simmer	1,610	3·9	184	27·9	24·1	36	42	271	334	1,488	1,486	37/8	37/4	238·3	237·4	3·2	3·2	235/2	233/6	2/1	2/7	12/10	16/1
Sub Nigel§	1,715	8·2	298	35·5	37·1	32	33	364	342	792	794	50/11	49/2	270·9	277·3	6·8	7·0	148/11	140/9	34/2	*37/10	99/10	108/4
Ventersposts§	2,496	5·6	307	36·2	30·7	43	53	384	344	1,219	1,180	46/3	42/8	285·1	260·6	4·7	4·4	197/11	193/4	11/11	12/4	50/11	55/9
Vlakfontein	1,358	8·4	346	28·8	32·4	35	29	347	322	446	447	50/8	50/-	161·0	165·1	7·2	7·4	140/5	135/5	38/9	42/2	107/4	113/11
Vogels‡	3,189	5·5	233	34·9	34·5	44	51	286	302	1,180	990	42/3	44/7	298·0	257·7	5·0	5·2	167/4	171/4	20/6	*20/7	81/1	78/11
W. Drie‡§x	—	—	—	12·6	10·7	100	100	833	693	387	115	62/9	66/-	261·7	49·2	13·5	8·5	93/-	154/3	104/11	*40/4	155/4	94/3

x 1952 figures for five month period only
** Calculated on stoping width
‡ Scheduled uranium producer
§ Figures shown are for the years ended June 30, 1952 and 1953 respectively

RIETFONTEIN CONSOLIDATED MINES LTD.

Situated on the East Rand to the north of Knights, Rietfontein is one of the smaller undertakings of the Gold Fields group but from its formation in 1934 up to December 31, 1953, it has crushed 5,875,428 tons for a working profit of £3,860,351, and has paid £1,743,701 in dividends to shareholders. Despite current difficulties it again made a satisfactory showing last year and was able to repeat the previous year's dividend.

In recent years, reclamation work has been going on with exploratory development and stoping in the upper levels and in the old eastern section of the mine. Gratifying results have been achieved and the life of the mine has been prolonged. To overcome the shortage of native labour, underground mechanization has been introduced.

The opening up of the remaining intact area adjacent to the granite is proceeding but progress is being retarded by excessive faulting. Exploratory work in the upper levels and in the eastern section continues to give satisfactory results. The mining title for an additional 12.0286 claims adjoining the eastern boundary of the mine is in course of registration.

In the No. 3 shaft area, adjacent to the new lease claims, development result have been encouraging and work in connection with the opening up of these claims has been expedited.

VLAKFONTEIN GOLD MINING CO. LTD.

Vlakfontein adjoins the Sub Nigel on the latter's western boundary and is working the extension of the Sub Nigel ore shoots. The tonnage milled in 1953 was of the same order as the previous year's record throughput but higher costs and a slight drop in the yield resulted in a lower working profit and the year's dividend payments totalled 1s. 1d. against 1s. 4d. in 1952. Development footage accomplished during the year showed higher payability and values.

Development continues to be mainly directed towards the opening up of the South-Western section of the mine. Good progress was made in sinking the No. 2 shaft, which early in 1954 reached a final depth of 6,810 ft., making this the deepest single lift shaft in the world. The advance during May, 1953, amounting to 585 ft., constituted a world record for speed in shaft sinking.

A development heading from No. 1 shaft is now in close proximity to No. 2 shaft and a connection is anticipated soon.

WEST WITWATERSRAND AREAS LTD.

West Wits was registered on November 12, 1932, and has completed 21 years of development on the West Wits line. During this period almost barren and undeveloped veld has been transformed into a prosperous mining area, five companies having been floated, all of which are now producing. In spite of the delays occasioned by the war the mines on the West Wits line have already produced gold to the value of over £100,000,000. Their expanding production is providing West Wits with a revenue from investments which, in the year ended June 30, 1953, amounted to £559,534 and is likely to go on increasing. The company's investments consist mainly of substantial holdings in these five undertakings, two of which are the richest gold producers in South Africa. Quoted investments stand in the balance sheet at £6,643,541 but their actual value is very much higher.

In addition to its large participations in the mining companies operating on its property, West Wits owns extensive freehold and mineral rights and options in the Far Western Rand and drilling is still being continued. Encouraging results have been obtained from boreholes in the area to the west of Doornfontein, where the existence of the upper reefs, main reef and carbon leader has been proved, but further drilling is being carried out before a decision can be reached regarding the best method of exploitation.

West Wits and other companies participating in the mineral rights over the area adjoining the southern boundaries of Blyvooruitzicht and West Driefontein mines have reached agreement regarding the terms and conditions on which they have decided to investigate the possibility of establishing a single mining unit for the exploitation of the composite area of approximately 10,000 acres.

Rapid progress is being made in the development of townships in the area administered by the subsidiary company of West Wits, Carletonville Estates Ltd., and with the expansion of operations at West Driefontein and Doornfontein there has been a growing demand for residential stands. This development, combined with extensive tree planting, is increasing the value of the land held by the two companies.

VENTERSPOST GOLD MINING CO. LTD.

Venterspost was the first mine on the West Wits line to start milling, production commencing towards the end of 1939. The reduction plant has recently been increased by 25,000 tons to a monthly capacity of 135,000 tons. This extension resulted in an increase in tonnage milled last year, although shortage of native labour and power prevented full advantage being taken of the additional milling capacity. The company has sought to minimize the effects of the labour shortage by further mechanization and other innovations.

Higher costs have resulted in a further exclusion of tonnage from ore reserves and there was a reduction in the payable footage of development disclosed during the year although there was a substantial increase in footage accomplished. The ore reserve at June 30, 1953, compared with that at June 30, 1952, shows a decrease of 37,000 tons, with the stoping width narrower by 1.7 in., and the value higher by 0.2 dwt. per ton. The lower percentage payability was caused by the poor results obtained on Main Reef, while the increase in value was caused by the greater relative proportion of payable footage obtained on the Ventersdorp Contact Reef. Development on this latter reef continues to give encouraging results.

Owing to delays which have been experienced in the shaft sinking programme, development has to some extent been restricted to the less promising areas of the mine but when the new shaft systems become available it should be possible to carry out a larger proportion of development in the main pay shoot areas. Development in the No. 1 shaft area cannot be carried out at depth until the No. 1 sub-vertical shaft becomes available, but it was anticipated that development of the lower levels in the No. 2 shaft area would be possible early in 1954 on completion of the ore and waste pass systems of the No. 2 and No. 2A incline shafts. Twin cross-cuts have been advanced to the site of the proposed No. 3 sub-vertical shaft and preparatory work prior to the commencement of shaft sinking will soon be started.

Although more water was encountered underground during the year ended June 30, 1953, the pumping capacity of the mine was fully adequate to deal with it.

LIBANON GOLD MINING CO. LTD.

Libanon is mining an area adjoining Venterspost to the south-west. The Main Reef and Venterspost Contact Reef are being worked.

The company has been severely affected by post-war inflation and by labour and power shortages. Milling started over five years ago but the throughput, though increasing, is still below 100,000 tons per month, the capacity of the reduction plant. Nevertheless, the working profit was higher last year by £33,763 and dividends totalling 6d. a share were again declared.

Development in the northern and southern areas of the mine on Main Reef continued to disclose satisfactory percentages of payable tonnage, while in the area to the east of No. 2 shaft promising results have been obtained from sampling on the Ventersdorp Contact Reef. Ore reserves for 1953 showed an increase of 73,000 tons over 1952 and the improved position reflects the satisfactory development in the No. 2 shaft area.

Since the company's policy of ensuring future supplies of mill tonnage now requires the more rapid opening up of the property, the sinking of a third vertical shaft in the next few years has become essential. Capital expenditure will therefore continue at a heavy rate for some years and this will delay any increase in the dividend rate.

DOORNFONTEIN GOLD MINING CO. LTD.

A major event of 1953 was the appearance for the first time of gold-mining returns from the Doornfontein Co. which started production on November 1. This mine adjoins the western boundary of Blyvooruitzicht and is the latest of the five mining companies floated to work properties on the West Wits line. Even allowing for the fact that the plant had been running-in on a trial basis for some time, the first return was wholly satisfactory. During the month 40 000 tons were crushed for an aggregate gold recovery of 10.227 oz. and a working profit of £6,563. In January, 1954, the throughput reached the initial plant capacity of 48.000 tons, yielding 14.406 oz. of gold for a working profit of £51,912.

Since the commencement of development operations in 1951 to March 31, 1954, the total footage advanced amounted to 67,720 ft., of which 23.735 ft. were sampled. The payable footage was 18,445 ft. (77.7 per cent), averaging 9.2 dwt. per ton over a stoping width of 42 in., equal to 386 in. dwt.

The mine has been opened up more quickly than was ex-

pected and development and shaft sinking have proceeded favourably, thanks largely to the absence so far of any significant inflow of water. Consequently, the capital cost of bringing the mine to production has been materially lower than it otherwise would have been. The exceptional progress made with shaft sinking and development, combined with the encouraging development results obtained during 1953, has made an increase in the scale of operations possible. Arrangements are therefore being made to reach a milling rate of 100,000 tons per month considerably earlier than had been thought possible. Any substantial increase in the milling rate, however, depends on the availability of the additional hoisting facilities of No. 1 shaft, the date of completion of which has been brought forward from 1957 to the middle of 1955, and every effort is being made to improve on this date. The additional capital required to undertake this more ambitious programme has been provided by means of temporary loan finance.

Later on, Doornfontein will also produce uranium, the slimes containing this metal being treated at West Driefontein.

WEST DRIEFONTEIN GOLD MINING CO. LTD.

Few mines have made such an impressive beginning as West Driefontein, which started milling on a limited scale in February, 1952. The first full year's operations yielded a working profit of £2,091,929 and a maiden dividend of 6d. per share was paid. With a throughput of only 387,500 tons the company was among the largest profit-earners on the Rand. The milling rate is now in the order of 50,000 tons a month. Bearing in mind that an eventual crushing rate of 125,000 tons monthly is envisaged, and that the uranium plant is estimated to be in operation by the middle of 1955, the future outlook for West Driefontein is bright indeed.

Development continues to give most satisfactory results. The Carbon Leader Reef has proved to be fully payable ever since development started. Values showed a considerable increase last year averaging 833 in. dwt. against 693 in. dwt. in 1952.

No. 1 shaft has been completely equipped and No. 2 shaft is nearing completion. Difficult ground is being encountered at No. 3 shaft, which by end-March, 1954, had reached a total depth of 2,378 ft.; the estimated final depth will be 4,500 ft. Sinking operations are to be resumed at No. 4 shaft and the sinking of No. 5 shaft has begun. The latter shaft will serve the south-western section of the mine, which appears to be one of the richest areas of the property. Sinking operations there will employ the highly mechanized methods which proved so successful at Vlakfontein, and on geological grounds less difficult sinking conditions are expected than obtained in earlier shafts.

WATERVAL (Rustenburg) PLATINUM MINING CO., LTD.

This company has a substantial interest in Rustenburg Platinum Mines Ltd. and further indirect interests therein through shareholdings in Potgietersrust Platinums Ltd. and Union Platinum Mining Co. Ltd.

Additions to the reduction plants at the Rustenburg and Union sections have been completed and both are operating to full capacity. Another important development in this undertaking is the construction at Rustenburg of a matte treatment plant which is scheduled for completion by the middle of 1954. This plant will be owned jointly by Rustenburg Platinum Mines Ltd. and Johnson, Matthey and Co., Ltd.

MOTAPA GOLD MINING CO. LTD.

This company was formed in October, 1946, to take over approximately 1,500 acres in the Bubi district of Southern Rhodesia. The mine is divided into two sections, the B and S Claims and the Fossickers, which are worked as a single undertaking. This venture was regarded as extremely promising but the results have not come up to expectations due to increased costs and the refractory nature of the ore. Results, as indicated from the monthly production returns issued by the company during 1953, show a perceptible improvement in both yield and profits—an encouraging feature which has been more than maintained during the current year.

LAKE VIEW AND STAR, LTD.

This is the largest undertaking operating on Western Australia's famous Golden Mile. Since its formation in 1910, the company has greatly extended its property, which now includes Ivanhoe Gold, Lake View Consols and Hannan's Star. Operations continue to be successful and a strong technical position has been built up. Development is giving satisfactory results and modernization of equipment underground has accelerated the opening up of ore.

During the year to June 30, 1953, the company milled the record total of 721,845 tons, against 652,247 tons in the previous year, while mill grade rose from 4.76 to 4.90 dwt. per ton. During the year 522,877 tons of residues were retreated for a yield of 8,371 f.oz. of gold. The total income from mining operations was £2,102,754 against £1,922,776. The gain was more than absorbed, however, by a rise in the cost per ton from 40s. 11d. to 42s. 4d., the mining profit being £465,596 against £482,151 the previous year.

The total development footage was 27,949 ft. compared with 23,232 ft. in 1951-52 and sampling disclosed 72.7 per cent payability with an average value of 5.8 dwt. over 60 in. On July 1, 1953, the ore reserve was 3,735,300 tons—a gain of 11,600 tons—and sufficient to supply the mill for over five years at the present crushing rate.

LAKE GEORGE MINING CORPORATION LTD.

This company through its operating subsidiary, Lake George Mines (Pty.) Ltd., works a complex base-metal ore body about 35 miles from Canberra, the Australian capital. The property was worked in Victorian days but it was abandoned due to lack of knowledge in dealing with complex ores. It has been successfully resuscitated under the ægis of the Gold Fields, production being restarted in 1939.

During 1951-52 the group profit, after taxation of £694,623, amounted to £389,727 but a loss of £9,099 is recorded for the year to June 30, 1953. This loss is attributable to the fall in revenue sustained by the operating company in Australia, Lake George Mines (Pty.), as a result of the decline in base-metal prices. Revenue from lead was lower by approximately £300,000 and revenue from zinc by nearly £1,000,000. After writing back provisions for taxation no longer required and adding in unappropriated profits from last year of £226,921, there remained £271,692 from which £200,000 was appropriated to reserves by the subsidiary, leaving £71,692 to go forward.

Technically, the mine is in a sound position with ore reserves of 1,603,100 tons averaging 6.4 per cent Pb., 11.5 per cent Zn., 0.62 per cent Cu., 1.18 dwt. gold and 1.39 oz. silver. At the present rate of crushing these are sufficient for many years.

According to the chairman of Lake George Mining Corporation, the Hon. R. M. P. Preston, the Lake George Mine would be a prosperous and profitable undertaking at present metal prices in almost any country but Australia. There has been a "staggering" increase in working costs in Australia in recent years. All-in costs at Lake George in 1947 were just under £A4 6s. per ton of ore milled. The corresponding figure in the year to June 30, 1953, was over £A10 14s. The chairman stated that he could hold little hope of the mine operating on a profitable basis in the immediate future.

Exploration had been in progress for some time on leases owned by Lake George Mines outside the limits of the three ore bodies now being worked. The results of diamond drilling suggest the possibility of a virgin ore body lying in the Kohinoor area to the north of Elliot's on what appears to be the extension of the Keatings-Central-Elliot's shearzone across the Molonglo fault. If this new ore body exists, it probably occurs below the horizon of the 1,550 ft. or present bottom level of the mine; further exploration will therefore be deferred until the Elliot's ore body has been opened up on the 2,030 ft. level. Development in the mine will be concentrated on opening up in depth both Elliot's and Keatings as rapidly as possible.

CAMP BIRD LTD.

Camp Bird was formed in 1900 principally for the purpose of working the Camp Bird Mine in Colorado, which is now operated on a small scale by a tributor. Nowadays the company's business is primarily mining finance. It has built up a valuable portfolio of investments, which include holdings in Blyvooruitzicht, Doornfontein, West Driefontein, Harmony Gold, New Consolidated Free State Exploration, Lake View and Star, and Lake George. While the company's interests are mainly in gold mines, its investments extend to base metals, platinum and timber, and include a holding in the Fresnillo Co., which operates a large silver-lead-zinc mine in Mexico and has various other mining interests in Mexico and the U.S.A.

Camp Bird's operations in the year ended December 31, 1953, reflect the difficulties experienced by both gold and base metal producers. The year's profits amounted to £127,813 against £211,607 in 1952. After adding £13,835 in respect of provision for excess profits levy no longer required and deducting taxation of £40,028 and transferring £50,000 to investment reserve, there remained £87,539 for appropriation. A dividend of 9d. per share (1s. in 1952) absorbed £44,836, leaving £42,703 to be carried forward. The company's quoted investments stand in the balance sheet at £1,196,341 and there are also unquoted holdings at £127,916. The market value of the quoted holdings, is easily in excess of the amount shown.

Anglo American Corporation of South Africa

EACH year witnesses a further expansion of the scope and activities of the Anglo American Corporation of South Africa, which for 37 years has been prominently associated with the mining and industrial progress of South Africa. The corporation's interests consist predominantly of investments in companies associated with the mining industry and, to a lesser extent, in industrial companies. These are held partly through associated finance and investment companies and partly by direct shareholdings. To-day, Anglo American administers a large number of companies and acts as consulting engineers to many other companies in the Union of South Africa and elsewhere. They have substantial direct interests in many other concerns.

Despite its far-flung interests the corporation continues to derive the greater part of its revenue from gold, copper, and diamonds. From the Far East Rand its gold mining interests have spread to the Far West and across the Vaal River to the new goldfield in the O.F.S. Once more this goldfield has fired the imagination of investors, following recent disclosures of exceptional development values in mines of the Anglo American group.

Through its large shareholding in the Anglo American Investment Trust, formed to administer its diamond interests, the Anglo American Corporation is associated with many companies concerned with the production and distribution of gem and industrial diamonds. The Trust holds 19.3 per cent of the deferred ordinary shares of De Beers Consolidated (which has controlling interests in other South African producers), and it also has substantial holdings in the selling companies set up by the South African diamond mines.

BASE METAL, COAL AND INDUSTRIAL INTERESTS

Anglo American has an indirect interest in the copper mining industry of Northern Rhodesia through Rhodesian Anglo American Ltd., which controls Rhokana Corporation, and has substantial shareholdings in Nchanga, Mufulira and Rhodesia Broken Hill. The Kafue River Hydro-Electric Authority recently decided to appoint the Anglo American Corporation as consulting engineers-in-chief for the £30,000,000 Kafue scheme.

In April, 1953, the Corporation took over the duties of managers, consulting engineers and buyers for Wankie Colliery Co. Ltd., thus obtaining control of the sole source of coal for the two Rhodesias.

Coal interests in the Transvaal are held through the medium of African and European Investment Co. Ltd. and its associated company, The Vereeniging Estates Ltd. The collieries controlled by these companies produce over 40 per cent of the coal produced annually in the Union.

Finally, the Corporation is interested in a number of industrial and sundry companies, which depend mainly on the mining industry for their markets.

On December 31, 1952, the book value of the "shareholdings and other interests" of the Anglo American Corporation stood at £19,257,500 having a market value of £31,988,095. Loans to associated companies, amounting to £15,436,208, testified to the substantial part played by the Corporation in financing the operations of its affiliated companies. Notes and debentures held amounted to £4,134,083. A preliminary report issued by the Corporation shows that profits for the year to December 31, 1953, after providing for taxation, amounted to £3,315,000 compared with £3,015,000 for 1952. The general reserve was increased to £18,900,000 by the allocation of £1,000,000. Dividend distribution for the year again totalled 6s. per share.

In September, 1953, Anglo American offered shareholders in New Era Consolidated Ltd., one of the older finance companies of the group, to acquire their shares at a purchase price of 35s. 3d. per share, of which 34s. 6d. was to be utilized in the subscription of fully paid ordinary shares of 10s. each in the Corporation at 115s. per share, the balance of 9d. being paid out in cash. The offer was accepted by holders of 1,028,881 shares, giving the Corporation a holding equivalent in value to more than 9/10ths of New Era's total issued capital. The holdings of dissentient shareholders have since been acquired.

RAND GOLD PRODUCING INTERESTS

The Corporation controls a group of gold producers on the Far East Rand comprising Brakpan Mines, Springs Mines, Daggafontein Mines, East Daggafontein and South African Land. In the Klerksdorp district, west of the Rand, it controls one producer, Western Reefs, and one developing mine, Vaal Reefs, and has interests in the three other large mines in the area. Daggafontein Mines and Western Reefs have entered into contracts with the S.A. Atomic Energy Board to produce uranium, from which both mines now earn additional profits.

Through its very substantial interest in West Rand Investment Trust, the Corporation has an indirect interest in the five mines working on the "West Wits line"—Blyvooruitzicht, Doornfontein, Libanon, Venterspost and West Driefontein. The Trust's profit after taxation for the year 1953 was returned at £784,000 compared with £514,000 in 1952. As well as raising the distribution to 1s. 6d. a share against 1s. 4½d. in 1952, the board transferred £250,000 to general reserve, raising that fund to £3,500,000. Several of the companies in which W.R.I.T.S. has large shareholdings have been scheduled as uranium producers. The Corporation has further interests in the Far West Rand through West Wit Areas and Western Ultra Deep Levels.

The Far East Rand producers were still handicapped last year by power and labour shortages, with the result that lower tonnages were crushed and working costs increased. Due to these difficulties, coupled with steep falls in the premium revenue, profits generally were down. Despite a difficult half-year four of the six companies in the group repeated their June dividends in December, though only Daggafontein and Western Reefs were able to maintain payments at the level of 1952. The footage payable has remained fairly constant but in some instances payability values have improved considerably (see table).

BRAKPAN AND SPRINGS MINES

Situated in the centre of the Far East Rand, Brakpan is a fully developed property with a long record of successful operation, but some capital expenditure on shaft sinking and equipment is still being incurred, the amount spent in 1953 being £14,646. The bulk of the ore supplies now comes from the Witpoort section, where the wide footwall reefs underlying the Main Reef Leader have yielded large tonnages of satisfactory grade. Reference to the table shows that although the total ore reserves declined by 378,000 tons, the values are unchanged and the width is higher. It is noteworthy that working costs in December were below the year's average of 40s. 4d. and in January this year they fell by a further 7d. to 39s. 6d.

As a "marginal" producer, Springs Mines was severely affected during 1953 by the lower tonnage milled and higher working costs, coupled with a fall in premium revenue amounting to some £45,000 (over 50 per cent). As a result, dividends were cut by half and were barely covered by earnings. Nevertheless prospects for this mine are not altogether discouraging. As in the case of Brakpan the mill head grade is well below

FINANCIAL RESULTS (*for the last two complete financial years*)

COMPANY (Year to Dec. 31)	ORDINARY SHARES IN ISSUE		PROFIT AND LOSS RESULTS £(000) Working Profit		Premium Revenue		Uranium Profit		Taxation and/or Mining Lease		Net Profit After Tax*		Capital Expenditure† £(000)		DIVIDENDS PER SHARE Paid 1953 June s. d.	Dec. s. d.	1952 June s. d.	Dec. s. d.
			1953	1952	1953	1952	1953	1952	1953	1952	1953	1952	1953	1952				
Brakpan	4,600,000	(5/-)	274·7	425·0	45·7	80·6	—	—	64·7	177·0	332·9	399·8	38·5	38·0	6	6	7½	9
Dagga‡	7,000,000	(5/-)	3891·8	4661·1	102·9	208·3	645·0§	—	2075·0	2265·0	2646·8	2683·9	61·1	63·2	3 0	3 0	3 0	3 0
East Dagga	3,730,000	(10/-)	588·9	746·0	34·2	67·0	—	—	285·2	388·0	342·2	428·5	—	—	9	10½	1 1½	1 0
S. African Land	2,475,000	(3/6)	623·6	822·4	38·4	72·7	—	—	275·6	401·4	396·6	500·9	28·6	18·3	1 3	1 6	1 9	1 9
Springs	10,110,000	(5/-)	112·1	249·4	42·8	84·5	—	—	10·7	21·5	149·0	317·3	Cr 4·9	Cr 5·5	1½	1½	3	3
Welkom‡x	10,000,000	(5/-)	118·0	—	28·9	15·1	—	—	7·1	34·8	109·4	15·1	1152·2	1613·2	—	—	—	—
Western Reefs‡	7,000,000	(5/-)	932·8	1226·7	47·2	84·0	246·6*a*	—	—	·7	1241·2	1325·2	424·9	461·6	1 3	1 3	1 3	1 3

* Includes sundry revenue less sundry expenses
† Excluding Capital spent on Uranium production
‡ Scheduled uranium producer
x Also loan capital
§ Subject to adjustment — covers 9 months' production
a Subject to adjustment — covers approximately 3 months' production

that of the ore reserves. The payable area of the Kimberley Reef horizon having been thoroughly explored, development is now concentrated on the Vlakfontein area in the southern section, where good payability and values are being obtained.

SOUTH AFRICAN LAND AND EXPLORATION

This company is deriving great benefit from earlier capital expenditure on ventilation and sub-vertical shafts, but due to the adverse factors affecting all Rand producers, profits and dividends could not be fully maintained in 1953. On this property too, the grade of ore being opened up is considerably higher than that being milled and if the monthly crushing rate could be raised to around 115,000 tons there is scope for a big improvement in profits.

DAGGAFONTEIN AND EAST DAGGAFONTEIN

Uranium's importance to the South African gold mining industry is shown by the results of the year's operations at Daggafontein Mines, which was able to maintain dividends at the 1952 level despite a considerable reduction in the revenue from gold mining. The company's uranium and sulphuric acid plants were officially opened by Sir Ernest Oppenheimer on May 22, 1953. In keeping with Daggafontein's size and position as a gold producer, these plants will be among the biggest in the Union. The estimated profits from the start of operations in the second quarter of the year up to December 31 amounted to £605,000 (including allowances totalling £91,000 towards the redemption of the capital cost of the acid plant). The grade of ore milled at Daggafontein during the year was fractionally lower than in 1952. At the end of 1953 ore reserves showed a decrease of 206,100 tons with a rather lower value and stoping width, but at the present crushing rate they remain several years ahead of the mill. Development is being increasingly concentrated on the Kimberley Reef (the uranium carrier), which has a higher gold value than the Main Reef Leader.

Shortages of labour and power again prevented East Daggafontein from operating to the maximum capacity of the reduction plant. Though earnings and dividends were on a lower level, the tonnage milled was well maintained and working costs per ton milled rose only by 9d. as compared with 1952. Both the Main and Kimberley Reefs are being developed, giving satisfactory pay ratios and values. At the end of the year ore reserves were within 28,000 tons of the estimated figure as at December 31, 1952, very slight decreases being recorded in the average value and stoping width.

WESTERN REEFS AND VAAL REEFS

Anglo American's gold producer in the Klerksdorp area, Western Reefs, started producing uranium and sulphuric acid towards the end of the third quarter of 1953. By December 31 its profits from this source amounted to £228,000 (including an allowance of £32,000 towards the redemption of the capital cost of the acid plant), thus exceeding the working profit of £214,108 derived during the fourth quarter from gold mining operations. This additional income was equivalent to nearly five times the total premium revenue in 1953. The company's uranium plant is the largest in South Africa so far officially opened.

Formerly mining at Western Reefs was confined to the Elsburg series, but the completion of No. 3 vertical shaft, which is a joint venture with Vaal Reefs, has made it possible to start development on the Vaal Reef, where 96.4 per cent payability averaging 1,125 in. dwt. was recorded during the third quarter of 1953. This promise was well maintained during the fourth quarter's development with 82.6 per cent payability and 831 in. dwt. At the end of the year the reserve on the Vaal Reef horizon amounted to 86,000 tons, having a value of 14.76 dwt. over a stoping width of 40.51 in. As can be seen from the table, the total ore reserves were increased during the year by 60,000 tons and stand at the imposing figure of 4,763,000 tons. The tonnage milled was approximately the same as in 1952.

Capital expenditure of £474,287 was incurred during 1953 on development and equipment, and a large programme of housing construction, for which no capital funds were available, was also foreshadowed. Although it was expected that this expenditure would be financed by temporary borrowings, shareholders were asked to place 1,000,000 5s. shares at the directors' disposal and to increase their borrowing powers from £5,000,000 to £6,000,000.

Vaal Reefs started development work on the Vaal Reef horizon from the joint shaft during 1953 and exposed the reef at several points. These exposures, together with those on the property of Western Reefs, extend over a distance of approximately 9,000 ft. and the average value obtained in the development in both properties is 745 in. dwt. over a total of 3,715 ft. sampled. The company's consulting engineers considered that the high development values so far obtained, in conjunction with the evidence provided by surface boreholes of the existence of the Vaal Reef over the whole of the property, justified an application for a mining lease and the equipment of the mine for crushing. It was also considered that the uranium values obtained in underground development and surface boreholes justified an application for the company to become a uranium producer. Both applications have been made.

Twin haulages have been driven on the 4,000 ft. level from the joint shaft to the site of the projected No. 1 shaft system and work on the cutting of the sub-vertical bank station and hoist chambers is far advanced. The simultaneous sinking of the No. 1 vertical and sub-vertical twin shafts will be started as soon as possible. The proposed reduction plant will have an initial milling capacity of 65,000 tons per month to be extended to 75,000 tons per month. It is estimated that the crushing of development rock can be started about the beginning of 1956 and the milling of stoping ore before the end of the year.

The additional capital required to carry out these proposals and to pay off temporary borrowings of £600,000 is estimated not to exceed £8,000,000. It is proposed to raise about £3,500,000 of new capital by the issue of further shares. Of this issue about £250,000 will be subscribed for under the flotation agreement by Western Reefs and Anglo American, and the balance will be offered to shareholders. Last year Selection Trust acquired a substantial holding in Vaal Reefs.

ORANGE FREE STATE INTERESTS

Pre-eminently associated with the development of the new field where expectations have so frequently been outstripped by results, are the names of the Anglo American Corporation and Sir Ernest Oppenheimer. Seven of the thirteen large new mines which have come into being within 14 miles of the new township of Welkom are being brought to production under the ægis of Anglo American, which is also directly or indirectly interested in all the others. The Corporation has taken a leading part in providing the industrial and residential ancillaries necessary to the opening up of a new gold field and was itself largely responsible for the development both of Welkom and of the newer town of Allanridge.

Apart from direct shareholdings, Anglo American is interested in the Orange Free State through its large investments in African and European Investment Co., South African Mines Selection, and the Orange Free State Investment Trust. Since its inception in 1944, "Ofsits," the instrument by which the Corporation acquired its large participation in the early stages, has continued to participate in the financing of the Orange Free State. Its large investment portfolio covering important participation rights and vendor interests includes nearly every Orange Free State company. At the end of last March the Corporation joined in discussions with Johannesburg Consolidated Investment, De Beers Investment Trust and Anglo Transvaal Consolidated to help work out a scheme for the amalgamation of Freddies North and South, which may involve the corporation in making a loan to assist the merger.

DEVELOPMENT AND MILLING RESULTS (*for the last two complete financial years*)

COMPANY (Year to Dec. 31)	TOTAL ORE RESERVES As at last report			DEVELOPMENT RESULTS						MILL THROUGHPUT													
				Ft. Sampled (000)		Payability				Tonnage				Gold recovered						Working Profit			
						%		Av. Value (In.-dwt.)		Milled (000)		Cost per Ton		Ounces (000)		Grade (dwt. per ton)		Cost per ounce		Per ton		Per oz.	
	Tons (000)	Value (dwt.)	(In.-dwt.)	1953	1952	1953	1952	1953	1952	1953	1952	1953	1952	1953	1952	1953	1952	1953	1952	1953	1952	1953	1952
Brakpan	3,548	4·7	209	45·9	52·6	28	28	740	555	1,377	1,419	40/4	38/10	246·3	254·8	3·6	3·6	225/7	216/3	3/11	6/-	22/4	33/4
Dagga‡	13,777	5·5	240	54·8	51·5	48	47	382	408	2,609	2,788	28/6	25/11	613·9	663·0	4·7	4·8	121/2	109/1	30/-	33/5	126/10	140/10
East Dagga	4,332	4·3	159	41·2	45·4	21	25	253	238	1,104	1,140	32/2	31/3	190·9	202·7	3·5	3·5	186/3	176/3	10/8	13/1	61/8	73/8
S. African Land	3,198	5·2	216	39·9	47·7	32	38	482	417	1,204	1,317	34/10	32/5	219·8	237·0	3·6	3·6	190/11	180/1	10/4	12/6	41/8	69/8
Springs	2,764	4·6	201	23·7	29·9	36	34	495	344	1,735	1,954	32/10	30/7	238·9	258·7	2·7	2·6	238/6	230/8	1/4	2/6	9/5	19/3
Welkom‡x	1,305	5·0	246	17·8	16·5	64	61	363	370	760	608	45/3	44/1	148·5	106·1	3·9	3·5	232/-	252/5	3/1	—	15/10	—
Western Reefs‡	4,763	4·9	233	42·7	8·8	51	43	430	359	1,312	1,345	36/3	33/9	267·1	280·3	4·1	4·2	178/1	162/2	14/3	18/3	69/10	87/7

• Includes sundry revenue less sundry expenses
† Excluding Capital spent on Uranium production
‡ Scheduled uranium producer
x Also loan capital
§ Subject to adjustment — covers 9 months' production
a Subject to adjustment — covers approximately 3 months' production

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URANIUM

Last year it was announced that two uranium plants were to be constructed on the properties of Welkom Gold Mining and President Steyn. These plants, on which work has already started, will jointly treat the slimes residues of any or all of five mines in the Welkom area administered by Anglo American, namely Welkom, the two Presidents, Western Holdings, and F.S. Geduld. It is expected that both plants should be complete late 1954.

WELKOM GOLD MINING

As a consideration for granting this company loan facilities up to £1,500,000, Anglo American have been given the right to subscribe at any time before December 31, 1957, for up to 1,000,000 shares in the company at 30s.

From £15,139 in 1952 Welkom's working profit rose to an estimated £150,502 last year, but results for the former year were seriously affected by the intersection of water-bearing fissures. A considerably greater tonnage was milled last year, but progress was again hampered by water-bearing fissures, particularly during the third quarter, when an unusually large number of development headings encountered fissures which required cementation. Preparations are being made for deepening No. 1 shaft and the temporary hoist has been commissioned. At No. 2 shaft the measuring bins have been installed and good progress made in cutting the belt station and ore passes.

Underground development continues to show good results and a satisfactory ore reserve position has been established. As at December 31, 1953, payable ore reserves were estimated to be 1,305,500 tons having an average value of 4.99 dwt. over a stoping width of 49.3 in. Compared with the ore reserve at the end of 1952, these figures show an increase of 331,000 tons. Under present conditions a milling grade of the order of 5 dwt. is entirely economic. The reduction plant was enlarged last year to a monthly capacity of 75,000 tons and further extensions now in progress will, in due course, bring it up to 125,000 tons.

THE TWO PRESIDENTS

An accelerated development and production programme at President Steyn is being financed by an amount of £4,000,000 made available by Anglo American by way of loans at 6 per cent, of which not less than one-half will be repayable in 1957 and the balance by the end of 1962, subject to any reduction by virtue of the corporation exercising its option to subscribe for 2,000,000 President Steyn shares at 20s. at any time up to mid-1955.

The reduction plant was in operation during 1953 for metallurgical and test purposes, and satisfactory progress was made on its extension to a capacity of 75,000 tons a month. During the fourth quarter of the year a total of 24,619 ft. of underground development was accomplished, of which 5,316 ft. were on the Basal Reef. Of the footage sampled on the Basal Reef horizon, 87.25 per cent proved payable averaging 82.89 dwt. over 7.23 in. There was no development during that period on the "A" reef, on which a limited amount of sampling took place in the previous quarters. The main connection haulages between Nos. 1 and 2 shafts are being advanced and at the end of the year the headings were 1,598 ft. apart.

Outstanding development results have been achieved by President Brand since the start of underground development of the Basal Reef. In the quarter ended June 30, 1953, 550 ft. sampled gave 99.10 per cent payability averaging 186.86 dwt. over 4.92 in., equivalent to 912 in. dwt. The next quarterly return showed a payability ratio of 96.13 per cent of the footage sampled, averaging 114.95 dwt. over 9.90 in. (1,138 in. dwt.). Still more impressive results were achieved during the last quarter of the year, with 99.12 per cent payability over 2,275 ft. sampled, averaging 104.73 dwt. over 17.04 in. (1,785 in. dwt.). It is early at this stage to suggest what grade of ore President Brand will be able to mill when the reduction plant comes into operation this year, but if these initial results are maintained the future for this coming producer should be very bright. The monthly capacity of the reduction plant is to be increased from 75,000 to 125,000 tons.

Under the capital scheme in which President Brand participated, £2,406,250 was raised by the issue of 2,750,000 reserve shares of 5s. each at 17s. 6d. and an additional £3,093,750 in April, 1954, by the exercise of option certificates in respect of a further 2,750,000 shares granted to subscribers of the issue at 22s. 6d. on a one for one basis. The offer to shareholders was 2,500,000 shares in the proportion of one for three, the remaining 250,000 being subscribed by the Anglo American Corporation, who underwrote the issue and agreed to lend the company any money it required at 6 per cent up to the end of April, 1954, the last day on which the options could be exercised.

WESTERN HOLDINGS

Western Holdings at the beginning of the current year set the Gold Share market ablaze by the astonishing values disclosed in actual development towards the area of the rich boreholes on the boundary with F. S. Geduld. From a point approximately 1,000 ft. from the common boundary a crosscut was developed and a borehole from this crosscut intersected the Basal Reef. Sampling on three sections gave an average value of 7,518 in. dwt.

The payable ore reserve at the end of 1953 stood at 786,900 tons having an average assay value of 10.078 dwt. over a stoping width of 48 in. Production started officially in July, resulting in a working profit of £30,036 for the third quarter, during which 109,000 tons were crushed for a working profit of £5 6s. 1d. per ton milled. In the fourth quarter the tonnage crushed was 134,000 tons, the working profit £91,508, and the working profit per ton milled £13 7s. 9d. The reduction plant is being extended from its present monthly capacity of 75,000 tons to 125,000 tons.

FREE STATE GEDULD

On October 30, 1953, Free State Geduld Mines announced that the Basal Reef had been cut in an underground borehole assaying 135.1 dwt. gold per ton over a width of 8 in., equivalent to 1,081 in. dwt., core recovery being incomplete. This borehole was sunk to locate the Basal Reef which had been displaced by a downthrow fault.

Operations at No. 2 shaft have been greatly hindered by serious water troubles, necessitating the insertion of concrete plugs, but the technical advisers were confident that the water in the fissure could be effectively sealed and that future development operations would not be unduly affected. By a major feat of mining engineering the flooded shaft was recovered. Development from the 5,150 ft. level was started during the second quarter of 1953, but there was no development on reef till the fourth quarter, when 70 ft. of Basal Reef were opened up. Sampling of 65 ft. showed 100 per cent payability with values averaging 136.02 dwt. over 12.77 in., equivalent to 1,737 in. dwt. The installation of the permanent equipment on No. 2 shaft has been completed and the erection of the second permanent surface fan on No. 1 shaft is proceeding. Good progress is being made on all sections of the reduction plant under construction, the capacity of which is being increased to 125,000 tons per month.

The authorized capital of this company was increased during the year from £2,000,000 to £2,250,000 divided into 9,000,000 shares of 5s. each. An offer was made to option holders of £2,750,000 6 per cent Registered Unsecured Convertible Notes of a nominal value of 55s. each, each note being convertible into one Ordinary 5s. share until January 29, 1955. Anglo American undertook to subscribe for the other £1,375,000 of notes, £500,000 of which were made available for subscription by F.S. Geduld shareholders.

LORAINE AND JEANNETTE

Two shafts are being sunk on both the Loraine Gold and Jeannette Gold properties. In order to finance Loraine, Anglo American agreed to subscribe at par for £5,500,000 Registered 6 per cent Unsecured Notes in two blocks—£3,500,000 in the early part of 1953 and £2,000,000 on January 1, 1954. The corporation holds options exercisable up to January 31, 1955, at 12s. 6d. per share for 100 Loraine shares for each £100 note subscribed. In March, 1953, £500,000 of the issue of notes were offered to shareholders at par.

In June, 1953, Loraine's No. 2 shaft intersected the Basal Reef and a complete exposure was obtained at a depth of 4,836 ft. Sampling gave an average value of 21.1 dwt. over an average channel width of 4.98 in. During the last quarter of the year 9,136 ft. of development was accomplished of which 1,780 ft. were on Basal Reef. Sampling showed a payability ratio of 61.96 per cent, averaging 50.57 dwt. over 6.87 in. By the end of the year No. 2 shaft had been sunk to its final depth of 5,515 ft. below the collar.

Early in 1953 Jeannette Gold Mines Ltd. decided to issue the balance of its working capital shares. Under the company's formation agreement Anglo American were obliged to subscribe or find subscribers for 2,154,383 of these shares. The corporation took up 1,256,000 shares and found subscribers for the balance. Its total holding in Jeannette Gold Mines is now 1,500,000 shares.

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De Beers Consolidated Mines Ltd.

IN 1953, De Beers Consolidated Mines Ltd. celebrated the centenary of the birth of its founder, Cecil Rhodes, to whose vision and enterprise was due the amalgamation of the Kimberley diamond mines. The company was incorporated in South Africa in 1888. Its earnings are derived in roughly equal proportions from the production of diamonds and income from investments.

DIAMOND INTERESTS

The principal diamondiferous properties are the De Beers, Kimberley, Wesselton, Dutoitspan (leased) Bultfontein (leased in perpetuity), Jagersfontein (leased), Kleinzee and Koffiefontein mines. De Beers also have pre-emptive rights over all diamond mines found in the lands of the South West Africa Co. and in territories of the British South Africa Co.

The Diamond Syndicate was formed in 1893 to meet the need for a Central Sales Organization to handle the De Beers output. After the first world war, it was agreed that the volume of trade should be divided on a quota basis between De Beers, the Premier Mine, Jagersfontein and Consolidated Diamonds, and that all diamonds produced under the quotas should be sold through the Diamond Syndicate. In furtherance of its policy of consolidation, De Beers subsequently acquired a controlling interest in the Premier (Transvaal) Diamond Mining Co. Ltd. and Consolidated Mines of South West Africa Ltd.

The finds at Lichtenburg and on the Namaqualand Coast resulted in enormous quantities of diamonds being thrown on to the market. To maintain prices the Diamond Syndicate had to take over large quantities of accumulated diamond stocks. The Diamond Corporation was formed to finance this operation. Its present function is to act as a link between the South African and other producers. It enters into periodical contracts to purchase the output of producers outside the Union of South Africa, the amount purchased being related to the volume of trade. Individual producers are guaranteed that sales will not fall below an agreed minimum, whatever the state of the market. The Diamond Corporation has contracts with producers in the Belgian Congo, Angola, Sierra Leone, Gold Coast and French Equatorial Africa. Contracts have also been entered into with Williamson Diamonds Ltd. (Tanganyika) and Akim Concessions Ltd. (Gold Coast). All these agreements have currency until December 31, 1955.

In 1930-31, the Diamond Corporation took over approximately £13,000,000 of diamonds at very low prices. During the severe depression which followed, deliveries were more than replaced by new purchases at even lower prices. These immense stocks were eventually disposed of so advantageously that the Corporation's cash resources rose to £40,000,000. Of this unforeseen windfall, the Corporation earmarked £20,000,000 for the protection of the diamond trade and employed the remainder of its resources in the establishment of the De Beers Investment Trust. The capital of the Diamond Corporation has recently increased to £20,000,000 in 20,000,000 shares of £1 each.

The marketing of gem diamonds is now conducted by the Diamond Purchasing and Trading Co. Ltd. and its associated company, the Diamond Trading Co. Ltd. The principal non-Union producers have shareholdings in both companies. The marketing of industrial diamonds is done through Industrial Distributors (1946) Ltd. and its subsidiary, Industrial Distributors (Sales) Ltd. The selling companies have cash resources totalling £14,009,000 and are thus amply financed for all contingencies.

By guaranteeing producers minimum sales over a period, the group ensures continuity of production. When the trends of price and demand warrant, considerable sums are spent in re-opening old mines which could not previously be exploited economically. Since the war the Premier Mine has been reopened at a cost of £3,993,000 and Jagersfontein at a cost of £1,980,000.

INDUSTRIAL AND GOLD INTERESTS

The De Beers Industrial Corporation Ltd. has an issued capital of £6,000,000 and 71¼ per cent of the Ordinary share capital is held by De Beers Consolidated. The Corporation owns 50 per cent of the Ordinary shares of African Explosives and Chemical Industries Ltd., the balance being held by Imperial Chemical Industries (S.A.) Ltd. The Corporation is also interested in the manufacture of carbide and of tungsten carbide tips through its holdings in Rand Carbide Ltd. and Hard Metals Ltd. respectively, and has helped to finance the opening of the colliery at Vierfontein, O.F.S.

The De Beers Investment Trust Ltd., with a nominal capital of £12,000,000, was registered in December, 1952, to take over the non-diamond interests of the Diamond Corporation. The bulk of its acquired shareholdings are represented by the newer developing and producing mines in the Orange Free State and the Far West Rand, some of which are likely to produce uranium. The funds for the development of these non-diamond operations have been mainly provided in the form of loans carrying conversion rights.

OPERATING RESULTS

The latest annual reports cover the year ended December 31, 1952. Mining and washing operations were continued throughout the year at Wesselton and Jagersfontein Mines and the alluvial deposits at Kleinzee. Dutoitspan Mine operated for the first eleven months, when mining was suspended and Bultfontein Mine was re-opened. This was in accordance with the company's normal practice of closing down one of its mines in order to concentrate on primary development. The total loads of ground washed amounted to 6,674,640, a decrease of 441,114 compared with 1951. Production from all operations totalled 786,354 ct., being a decrease of 30,703¼ ct. A second additional unit was installed and brought into operation at the washing plant. A new recovery plant has been completed and all concentrates from the washing plant are further concentrated in a small heavy-media separation plant. All washing plant tailings are now being disposed of by means of belt conveyor. These improvements and innovations will result in better efficiency and lower costs.

The Consolidated Diamond Mines of South West Africa produced 512,674 ct. in 1952 compared with 478,075 ct. the previous year. The Premier (Transvaal) Diamond Mining Co. Ltd. recovered a total of 1,293,548 ct. from 4,887,025 loads treated during the year, compared with 1,134,942 ct. from 4,354,675 loads washed in 1951.

The aggregate output of De Beers Consolidated Mines Ltd. and these two subsidiaries was 2,592,576 ct. compared with 2,430,075 ct. in 1951.

Owing to the reduced production from its directly owned mines, the revenue of De Beers Consolidated on diamond account decreased by £1,156,171 to £7,694,555. This was partially offset by interests and dividends on investments, which at £7,077,612 were higher by £155,429. The profits for the year 1952 were £11,917,399 compared with £12,938,555 for 1951. Nevertheless, the year's dividends on the 5 per cent Deferred shares were comfortably maintained at 200 per cent. An interim dividend of 80 per cent was declared in September, 1953, and a final dividend of 120 per cent in March, 1954.

FUTURE PROSPECTS

The boom times have ended and both sections of the diamond grade—gem and industrial—are adjusting themselves to normal business conditions. In these circumstances, some reduction in sales of both classes of diamonds is to be expected. The total net sales of diamonds effected in 1953 through the Central Selling Organization amounted to £61,155,941 compared with £69,661,926 in 1952. Gems fell from £45,769,857 to £43,336,109 and industrials from £23,892,069 to £17,819,832. The virtual cessation of stockpiling accounts to a considerable extent for the fall in sales of industrials.

The conservative dividend policy followed by the group has resulted in a very strong position to meet any further fluctuations in demand without financial worry. The consolidated balance sheet shows total assets at £105,038,000. This sum is covered by capital reserves on the liability side of the consolidated balance sheet, of which share premium account amounts to £10,053,000 and other capital reserves to £22,182,000. Current assets, loans to other companies and investments total £66,722,000, and exceed all liabilities to the public, including minority shareholders' interests, by £34,927,000.

At the end of 1952 the total stock held by the De Beers company itself was only £311,947 at cost of production; held by Consolidated Diamond Mines £414,055 at cost of production; and held by the Diamond Corporation £5,782,832 at cost of purchase.

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African & European Investment Co. Ltd.

INCORPORATED in the Transvaal in 1904, the African and European Investment Co. Ltd. will be 50 years old on August 27. This enterprising company was formed to acquire from Messrs. Lewis and Marks large areas of freehold property in various districts of the Transvaal and the Orange Free State, together with the business and assets of the African and European Agency Ltd. From its inception it has been closely associated with the gold and coal mining industries of South Africa and has also engaged in farming and real estate operations. Since coming under the aegis of the Anglo American Corporation its interests have been considerably broadened. Besides being the company through which Anglo American's substantial colliery interests are principally held, it now has large shareholdings in a number of O.F.S. companies as well as interests in other mining and industrial undertakings in South Africa and elsewhere. In addition, the company owns valuable land and mineral interests and town properties. This well-known mining finance house can look back with pride on half a century of steady progress during which period it has earned profits equivalent to several times the issued capital of £3,050,000.

O.F.S. INTERESTS

African and European was among the first companies to appreciate the potentialities of the Orange Free State and obtained options over large areas of ground with mineral rights and vendor interests. Some of these rights have been ceded to other participants, thus giving the company substantial holdings in a number of new O.F.S. enterprises.

The company became interested in the O.F.S. goldfield 17 years ago: even allowing for the intervening war period, this is a long time to wait for the fruition of the considerable sums spent in prospecting and in financing new ventures.

Among the areas over which African and European held mineral rights was a large block of farms known as Block 7, the western portion of which now constitutes the lease area of three mines, Welkom, President Brand and President Steyn, in all of which the company holds substantial investments partly acquired as vendor's considerations. Welkom and President Steyn are already producing gold, and the reduction plant of President Brand is at present operating on a test basis preparatory to the starting of production during the current year. The preservation of the company's equities in the new mines has called for much greater contributions than originally anticipated, but useful dividends can be confidently expected from these sources in the years ahead. Part of the company's rights in the balance of the Block 7 area were retained for further exploration and encouraging disclosures have been made by New Consolidated Gold Fields and Union Free State Mining on farms adjoining those held by the company. These farms include Homestead, Saaiplas, La Riviera and Harmony.

Besides the shareholdings derived from its original Block 7 interests, shares have been acquired in other companies interested in the O.F.S., including Orange Free State Investment Trust, Orange Free State Land and Estate Company, St. Helena, and Lydenburg Estates. African and European is thus well entrenched in this new goldfield, where the hopes roused by exceptional borehole disclosures are now being borne out by the results achieved during actual development.

LYDENBURG ESTATES LTD.

African and European has further interests in the O.F.S. through its shareholding in Lydenburg Estates. The latter company was reconstructed in 1938 to acquire options and mineral rights in the Eastern Transvaal and the Orange Free State. These have matured into shareholdings in several leading O.F.S. mining companies, including Welkom, President Brand, President Steyn, Virginia and Merriespruit. The company still owns mineral and participation rights in the O.F.S.

Lydenburg has leased to Munnik Myburg Chrysotile Asbestos Ltd. the right to mine asbestos on its farm Joubertsdal and receives in return a royalty on all asbestos obtained. It had been expected that this agreement would result in a permanent and considerable royalty income, but severe competition with Canadian and other suppliers in a buyers' market has resulted in a considerable recession in the prices obtainable for South African fibres. In these circumstances, future royalty income from this source is likely to be materially reduced.

Lydenburg's royalty revenue during the year ended June 30, 1953, amounted to £18,338, against which the board reserved a sum of £2,000 for probable adjustments. At the end of June 1953, quoted investments appeared in the balance sheet at £230,000 and had a market value of £404,000. Mineral rights in the Transvaal were valued at an additional £32,000 and participation rights in the O.F.S. at £43,000.

COLLIERY INTERESTS

Inseparably linked with the early development of coal mining in South Africa are the names of Lewis and Marks. It was natural, therefore, that from its earliest days African and European should have been actively associated with the progress of this key industry, in which it has a very substantial stake. Besides coal rights over an area of 187,985 acres, it has large direct holdings in leading colliery companies, as well as indirect interests through its associated company Vereeniging Estates Ltd., whose subsidiary companies include Amalgamated Collieries of South Africa, the Coronation Collieries, and Springbok Colliery. Vereeniging Estates is also largely interested in South African Coal Estates and Vryheid Coronation. The latter company is a subsidiary of Coronation Collieries. Together with Blesbok Colliery, in which African and European is also interested, they produced 12,137,524 tons of coal in 1953, as well as 432,991 tons of coke.

For several years the South African coal industry has been severely handicapped by inadequate railway transport, which critically affected the export trade. During the financial year 1952-53 the S.A.R. managed to increase the volume of coal moved by rail from the mines by more than 1,500,000 tons. This improvement has been progressive; e.g. in October, 1953, 124,611 tons were moved to the ports for shipment purposes, compared with 50,307 tons in June. Improved railway facilities must benefit the Union's coal industry as a whole, though Mr. R. B. Hagart, chairman of African and European, has emphasized that no early recovery of the lost export trade is expected.

Amalgamated Collieries—the Union's largest coal producer—recorded an output of 7,409,239 tons in 1953 compared with 7,864,138 tons in 1952, the drop in production being due largely to the fact that one of its subsidiary companies, Largo Colliery, reached the end of its economic life in November, 1953, and ceased production. Coronation Collieries produced 1,068,355 tons against 1,097,549 tons in 1952, while S.A. Coal Estates raised production from 1,641,706 tons to 1,670,904 tons. Vryheid Coronation produced 512,783 tons of coal and 432,991 tons of coke against outputs of 492,863 tons and 289,672 tons respectively in 1952. Vereeniging Estates is also interested in the New Largo Colliery, Vierfontein Colliery, and Natal Exploration Co. New Largo came into production in January and produced a total of 568,460 tons in 1953. Vierfontein started producing in May and had an output of 350,931 tons. Natal Exploration was expected to become a producer early in 1954.

Vereeniging Estates also owns the entire issued capital of the Transvaal Coal Corporation, which owns an area of approximately 12,700 morgen in the Eastern Witbank coalfield, estimated to contain millions of tons of good quality coal.

Outside the colliery industry, Vereeniging's most important participation is its substantial shareholding in Vereeniging Brick and Tile Co. This company manufactures refractories, salt glazed sewer pipes and fittings, building bricks, and other earthenware products.

OTHER INTERESTS

African and European has long been interested in the asbestos industry through royalties received from Amosa Limited, a subsidiary of Cape Asbestos Limited, on amosite mined on certain of the company's farms in the Lydenburg district. Other asbestos interests include Munnik Myburgh Chrysotile Asbestos and Rhodesia Monteleo Asbestos.

Another undertaking in which African and European is interested is the Union Steel Corporation, the Union's oldest steel producer, which operates two works at Vereeniging.

FINANCIAL RESULTS FOR 1953

The company's accounts for the year ended December 31, 1953, show that total revenue amounted to £1,118,599 compared with £1,080,423 in 1952. After providing for taxation, the year's profit was £728,795 against £779,344. Dividend on the £1,300,000 Ordinary stock was maintained at 25 per cent for the fourth successive year. The sum of £300,000 was transferred to general reserve. Apart from real estate, mineral rights, etc., which had a book value of £476,419, the company's principal assets are its investments, amounting in value to £7,804,550. Quoted investments appear in the balance sheet at £6,979,823, their market value on December 31, 1953, being £11,581,742.

The Central Mining & Investment Corporation Ltd.

THE Central Mining and Investment Corporation Limited was incorporated in England in May, 1905, to take over the business of the African Ventures Syndicate Ltd., and in 1910 the Corporation acquired the goodwill and most of the assets of the firm, Wernher, Beit and Company.

Rand Mines, Ltd., was registered in the Transvaal in 1893 for the purpose of acquiring certain assets, including mining claims and shares from the partnership of H. Eckstein and Company, which was the South African counterpart of the London firm of Wernher, Beit and Company.

The Central Mining/Rand Mines Group is frequently referred to as the "Corner House Group," a title attributed to the address of one of its founders—Herman Eckstein—whose Johannesburg office was at the time located in the Corner House. These offices were demolished in 1902 to make way for the present nine-storeyed, steel framed building.

Gold Mining: The Group is responsible for the technical and administrative control of 12 producing gold mines, situated in the Transvaal, one developing company—Harmony Gold Mining Company Limited—in the Orange Free State, and also certain important land, coal and industrial undertakings including:

Mining and Finance: Central Mining Free State Areas Ltd.; Rand Mines, Ltd.

Coal Mining: Witbank Colliery, Ltd.

Industrial: The Hume Pipe Company (South Africa) Ltd.; The Northern Lime Company, Ltd.; Pretoria Portland Cement Company, Ltd.; S.A. Forest Investment (Proprietary) Ltd.; Transvaal Consolidated Land and Exploration Company Ltd.

In addition to their shareholdings in the "Group" companies, both the Central Mining and Rand Mines have a considerable interest in other gold mining and industrial companies in South Africa and in the exploration and development of the Orange Free State goldfield.

Outside South Africa, the major interest of the Corporation is in the oil industry through its association with Trinidad Leaseholds Ltd.

Comparative statistical tables relating to the Group's gold producing companies are to be found at the foot of these pages and some of the interests are dealt with under separate paragraphs.

BLYVOORUITZICHT GOLD MINING CO. LTD.

This company is situated in the Far West Rand and its property covers an area of some seven square miles. It commenced operations in February, 1942, and entered the dividend paying stage four years later; since when it has distributed just over £19,000,000, or 13 per cent, of the total Rand declarations during that period. Its proportion of the 1953 declarations was 17 per cent.

Compared with the previous year's results the working profit of £6,362,500 (for the financial year to June 30, 1953) from gold mining showed the substantial decrease of nearly £1,333,000. This was due to the reduced tonnage milled, the lower yield, the fall in the premium sales of gold and increased working costs. The lower yield conformed with the reduction in value of the ore reserves over the past few years, while the movements in the tonnage milled and unit working costs were due principally to the severe decrease in the average number of non-European underground employees. Under the conditions of the serious labour shortage, which is common to the whole gold mining industry, it was necessary, especially as the mine is in the relatively early stages of its career, to preserve the balance between productive and non-productive work by spreading the limited labour as available to the best advantage over the various operations at the mine. Even against this background sufficient ore was developed to maintain the available reserve at very nearly the same tonnage as at the end of the previous year.

The uranium plant commenced operations in April, 1953, but, due to initial plant difficulties, output was restricted and the estimated profit for the period to June 30, 1953, amounted to £21,710. Since that date the plant has operated reasonably satisfactorily and it was hoped that it would be in the position to operate at full capacity by the end of 1953. Profits for the quarter ended September 30, 1953, and December 31, 1953, have amounted to £95,000 and £147,000 respectively.

In so far as lease consideration and taxation are concerned, the income from uranium is merged with that from gold and these liabilities are calculated by applying the lease and tax formulas to the combined revenue, costs and profits from both sources; likewise, the redemption allowance is calculated on the total capital expenditure in respect of gold and uranium.

The heavy capital expenditure on uranium during the past three financial years has resulted in the total lease consideration and tax liabilities of the company being less by about £900,000 and, although the unappropriated balance has increased by £850,000 during this period, it should be appreciated that the total dividends paid would probably have been less had the company not received the substantial benefit of the redemption allowance in respect of uranium capital expenditure. It is anticipated that the rate of capital expenditure on the gold mining section of the company's operations will decrease during the next five years and as the uranium plant is practically completed the annual redemption allowance will in future be substantially less with consequent increases in the lease and tax payments.

CROWN MINES LTD.

In the eastern portion of the mine, development was again concentrated on the more promising areas and steady progress was made with development in shaft pillars in order to prepare them for extraction. Approximately 75 per cent of the ore developed on the Main Reef Leader in the lower levels was located in the western portion of the mine where normal development and incline shaft sinking were continued and last year's values were maintained. It has not as yet been ascertained, however, whether the Vierfontein dike extends into this area of the mine. In the central section of the mine, development continued to be selective, but the values encountered were not encouraging. The shortage of both European and non-European labour was more acute than in the previous year but it was, nevertheless, possible to increase slightly the tonnage of ore milled due to a material increase in the amount of ore drawn from surface dumps. As ore is drawn from the surface dumps at low cost the increase in the tonnage treated from this source favourably affected working costs which were lower by 8d. per ton milled.

FINANCIAL RESULTS (*for the last two complete financial years*)

COMPANY	ORDINARY SHARES IN ISSUE		PROFIT AND LOSS RESULTS £(000) Working Profit		Premium Revenue		Uranium Profit		Taxation and/or Mining Lease		Net Profit After Tax*		Capital Expenditure† £(000)		DIVIDENDS PER SHARE Paid 1953 June s.	d.	Dec. s.	d.	1952 June s.	d.	Dec. s.	d.
			1953	1952	1953	1952	1953	1952	1953	1952	1953	1952	1953	1952								
Blyvoor‡§	24,000,000	(2/6)	6172·6	7342·4	189·9	352·6	21·7	—	2918·7	4025·3	3506·9	3708·7	554·0	450·0	1	4	1	4	1	6	1	6
City Deep	2,026,832	(£1)	254·6	318·4	63·6	119·1	—	—	6·6	9·3	344·7	457·2	143·8	264·6		6		6	1	6	1	0
Cons. Main Reef§	1,247,602	(£1)	269·7	507·0	75·1	139·3	—	—	84·3	180·0	304·3	436·2	26·8	10·1	1	9	1	9	2	9	2	3
Crown Mines	1,886,125	(10/-)	519·4	485·0	85·5	163·7	—	—	24·2	9·3	633·8	686·5	Cr42·5	165·8	2	6	3	0	2	6	2	6
Durban Deep	2,325,000	(10/-)	749·2	1014·0	62·1	116·1	—	—	144·2	296·7	679·7	819·5	224·0	363·6	1	9	1	9	2	6	2	0
E. Rand Prop.	3,960,000	(10/-)	1358·1	1704·7	84·7	166·1	—	—	328·1	495·6	1182·1	1384·7	380·2	834·6	1	9	1	9	2	6	2	6
Modder B.	2,800,000	(2/6)	23·5	73·6	12·5	22·5	—	—	5·2	30·3	51·6	92·6	Cr15·9	Cr 4·3	—		—		—		—	
Modder East§	930,805	(£1)	238·6	353·4	41·1	72·9	—	—	115·4	174·3	182·5	247·9	Cr13·4	—	1	6	1	6	2	0	1	6
New Modder§	2,800,000	(3/6)	49·4	29·7	4·6	15·1	—	—	24·6	0·9	38·1	58·3	Cr18·7	Cr21·3	—		—		—		—	
Rose	700,000	(19/-)	105·5	116·0	23·5	41·5	—	—	12·2	22·4	124·0	150·9	11·0	5·5	—		—		1	9	1	3
Transvaal G.M.E.	852,500	(£1)	27·1	16·0	10·8	19·2	—	—	5·1	4·6	62·6	72·6	29·3	7·4		6		9		9		9
Welgedacht§	1,358,030	(10/-)††	51·8	50·1	12·7	20·8	—	—	—	—	54·9	58·2	3·4	Cr 3·2	—		—		—		—	

* Includes sundry revenue less sundry expenses
† Excluding Capital spent on Uranium production
‡ Scheduled Uranium Producer
†† Also Loan Capital
§ Figures shown are for the years ended June 30, 1952 and 1953 respectively

DURBAN ROODEPOORT DEEP LTD.

The upward trend in costs continued, though at a less severe rate, and it would appear to depend largely on the degree of shortage of European and non-European labour whether and to what extent this trend can be arrested. The development results for the year were satisfactory in that percentage payability and values were higher than they have been for some years.

HARMONY GOLD MINING COMPANY LIMITED

The company was formed in August, 1950, for the principal purpose of acquiring a mining lease from Union Free State Coal and Gold Mines Ltd. (now in voluntary liquidation) in respect of an area of some 5,517 claims comprising the "Harmony Block" of farms in the district of Ventersburg, O.F.S., and of carrying on gold mining operations on the lease area.

Capitalization

Share Capital

Authorized: £4,500,000 in 18,000,000 5s. shares
Issued: £3,910,000 in 15,640,000 5s. shares

Loan Capital

£2,266,667 in 6 per cent Registered Unsecured Convertible Notes which can be converted at any time up to December 31, 1955, into ordinary shares on the basis of 5 shares of 5s. each for every £6 nominal value of Notes.

Financial Arrangements

The initial financing of operations at the property was undertaken by Union Free State Coal and Gold Mines Ltd. up to the end of January, 1951, when the Harmony company took over the operations on its own behalf and refunded to the Coal and Gold company the expenditure incurred out of the proceeds of the original capital issue. The provision of the finance has been made in the following stages:

(1) *End of 1950*:—

£2,000,000 was raised from issue of 8,000,000 shrs. at 5s.

(2) *March, 1952*:—

£5,180,000 was raised from issue of 5,600,000 shrs. at 18s. 6d.

(3) *November, 1953*:—

£2,040,000 was raised from issue of 2,040,000 shrs. at 20s.

£9,220,000 — 15,640,000

(4) *November, 1953*:—

£2,266,667 was raised from Note Issue at par.

The additional working capital of £4,307,000, raised by the latest offer of shares and notes (which was subscribed to the extent of 97.4 per cent), is considered to be sufficient to bring the mine to production during the second half of 1954 and to allow for certain further capital expenditure thereafter.

The company has been accepted as a uranium producer and arrangements have been made with the authorities in Washington and London for loans to meet the capital cost of the treatment plant, estimated to be of the order of £3,300,000. The price payable for the uranium produced will be related to the cost of production on a basis that will ensure the redemption of the capital cost of the plant, together with interest, over the ten-year period of the contract and will provide a satisfactory margin of profit.

Progress of Mining Operations

Two circular shafts, each 24 ft. in diameter, have been sunk to the Basal Reef; development operations commenced in February, 1953; the milling of ore from stoping and development sources is planned to start in July, 1954. It is estimated that when the production stage is reached, over 10,000 ft. will have been developed on reef and that the ore reserve will be in excess of 500,000 tons. Development disclosures to December 31, 1953, have been as follows:

Period 1953	*Feet Sampled*	*Feet*	*%*	*Payable Dwt.*	*In.*	*In. Dwt.*
February to June 30	1,505	1,280	85	16.6	44	729
Quarter ended September 30	3,090	3,005	97	15.5	44	680
Quarter ended December 31	2,485	2,465	99	11.5	39	450
Totals and averages to December 31	7,080	6,750	95	14.4	42	606

Erection of the first 45,000 ton unit of the gold reduction plant started in July, 1952, and if there are no unforeseen delays the plant should be completed before the end of June this year. The second 45,000 ton unit is planned to come into operation in July, 1955.

No decisions have yet been taken regarding the possible further extension of the reduction plant or when the sinking of the proposed second hoisting shaft will commence. A suitable site for this shaft has been located by the drilling of borehole L.R. 9 which gave encouraging values from intersections of the Basal Reef. The three intersections of the Basal Reef at a borehole depth of 5,028 ft. averaged 18.34 dwt. over 71 in., equal to 1,302 in. dwt.

Even if the present shortage of labour in the mining industry persists, it is hoped that the mine will be milling at least 40,000 tons per month by the end of 1954 and 75,000 tons per month by the end of the following year.

With regard to the plant that is in process of construction for the production of uranium, the aim is to bring it into operation at the same time as the first unit of the gold plant but it is probable that uranium production may start several months later than that of gold. The profit to be derived from uranium and to be added to that from gold mining is expected to be material. Uranium values have been encouraging and it is estimated in the light of disclosures to date that the profits (after allowing for loan redemption and interest) earned from the uranium plant during the period of the agreement with the Minister of Mines will be of the order of one-third of the working profits from gold mining.

COLLIERY INTERESTS

Witbank Colliery Ltd.—The Colliery is situated in the Witbank district of the Transvaal and is some 60 miles east of Johannesburg; it produces from two Sections—Southern Section and Wolvekrans Section.

During the year ended August 31, 1953, although production was restricted on account of inadequate and erratic supplies of railway trucks, a slight increase in the tonnage despatched from the Wolvekrans Section was recorded compared with the previous year. In April, 1953, the Southern Section recommenced production for the purpose of supplying the Witbank Power Station with crushed coal. The erection of a new coal washing plant at the Wolvekrans Section is progressing satisfactorily and is expected to be in operation by the end of March, 1954. Capital expenditure during the past financial

DEVELOPMENT AND MILLING RESULTS (*for the last two complete financial years*)

COMPANY	*TOTAL ORE RESERVES As at last report*			*DEVELOPMENT RESULTS*						*MILL THROUGHPUT*													
				Ft. Sampled (000)		*Payability*				*Tonnage*				*Gold recovered*						*Working Profit*			
						%		*Av. Value (In.-dwt.)*		*Tons Milled (000)*		*Cost per Ton*		*Ounces (000)*		*Mill Grade (dwt. per ton)*		*Cost per ounce*		*Per ton*		*Per oz.*	
	Tons (000)	*Value (dwt.)*	*In.-dwt.*	1953	1952	1953	1952	1953	1952	1953	1952	1953	1952	1953	1952	1953	1952	1953	1952	1953	1952	1953	1952
Blyvoor‡§	6,864	12·4	574	15·0	14·6	94	95	578	588	1,219	1,298	48/7	44/7	732·7	819·2	12·0	12·6	80/10	70/7	101/3	112/11	168/6	179/2
City Deep	5,700	5·8	248	37·3	23·7	35	32	282	300	1,922	1,851	45/2	47/3	371·0	375·8	3·9	4·1	234/2	232/9	2/8	3/6	13/8	16/11
Cons. Main Reef§	3,983	3·7	194	31·3	32·7	41	48	262	227	2,107	2,283	32/2	29/8	293·9	312·4	2·8	2·7	230/5	217/1	2/6	4/5	18/4	32/6
Crown Mines	12,208	4·9	237	45·3	56·4	59	52	386	330	3,272	3,253	36/1	36/9	518·6	518·2	3·2	3·2	227/11	231/1	3/2	3/-	20/-	18/8
Durban Deep	8,451	4·3	255	41·6	46·4	73	65	348	308	2,143	2,168	34/5	33/7	357·8	372·3	3·3	3·4	206/1	195/5	7/-	9/4	41/11	54/6
E. Rand Prop.	7,987	5·3	257	16·1	16·3	64	68	370	394	2,273	2,451	43/4	40/-	506·6	528·7	4·5	4·3	194/4	185/5	11/11	13/11	53/7	64/6
Modder B.	336	3·9	202	—	—	—	—	—	—	651	675	25/11	25/7	69·7	74·5	2·1	2·2	242/3	231/8	9d.	2/2	6/9	19/9
Modder East§	2,904	3·0	132	11·1	12·2	24	20	178	180	1,382	1,409	25/5	24/6	159·4	165·7	2·3	2·4	220/-	208/3	3/6	5/-	30/-	42/7
New Modder§	—	—	—	—	0·9	—	37	—	152	94	209	37/5	33/8	18·0	30·5	3·9	2·9	194/1	230/7	10/6	2/9	54/10	19/6
Rose Deep	1,394	3·9	229	14·5	31·2	37	38	345	329	865	983	34/8	32/8	129·3	137·7	3·0	2·8	231/8	233/-	2/5	2/4	16/4	16/10
Transvaal G.M.E.	225	7·9	—	8·6	10·1	38	43	234	347	319	331	51/8	47/4	65·5	62·6	4·1	3·8	251/6	250/-	1/8	1/-	8/3	5/1
Welgedacht§	511	2·8	106	3·9	5·4	29	49	133	148	404	405	28/4	27/2	49·8	47·8	2·5	2·4	229/8	230/6	2/7	2/5	20/10	20/11

* Includes sundry revenue less sundry expenses
† Excluding Capital spent on Uranium production
‡ Scheduled Uranium Producer
†† Also Loan Capital
§ Figures shown are for the years ended June 30, 1952 and 1953 respectively

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year totalled £211,000 and the amount of approximately £255,000, which it is estimated will be expended on this account during the current year will, it is considered, be sufficient to complete the present programme. The financing of this large sum out of the company's own resources has resulted in the cash resources being fully absorbed. Once this programme has been completed and allowance has been made for strengthening the cash position, there should be scope for an improvement in the rate of dividend distributions, which have been restricted to 3s. 6d. per share per annum during the last two financial years.

Van Dyk's Drift Colliery.—This Colliery is situated in the Witbank district of the Transvaal and is owned and operated by the Transvaal Consolidated Land and Exploration Company Ltd. The results achieved during the last three years have been as follows:

	Tons despatched ('000)	*Working Profit (£'000)*
1951	561	80
1952	558	100
1953	572	123

INDUSTRIAL INTERESTS

Pretoria Portland Cement Company Ltd.—This company was formed in 1895 and operates cement factories at Pretoria, Mafeking, Klerksdorp and Johannesburg. In addition, through subsidiary and associated companies, it has interests in cement factories in the Cape Province and in Rhodesia.

After charging taxation, the net profit for the year ended June 30, 1953, amounted to £444,000 compared with £344,000 during the previous year. The total commitments for the year involved a heavy drain on the company's revenue and accumulated funds and dividends were in consequence reduced from 4s. 6d. to 3s. 6d. per share. With the bringing into commission of the new kiln at the Pretoria factory the present construction programme has been virtually completed. However, the extent and cost of complete modernization of all its factories is at present under investigation and as it is certain that the funds required for the purpose will be substantial, it has been considered prudent to make large appropriations to reserves. During the current year the trading results of the company and its subsidiaries have been at a satisfactory level.

The Hume Pipe Company (South Africa) Ltd.—This Company, which has been in existence since 1918, manufactures reinforced concrete pipes, bricks and tiles from its factories located in the Transvaal and Cape Province.

Profits, after providing for taxation, amounted to £234,000 for the year to June 30, 1953, as compared with £266,000 during the previous year. Dividends, including bonus, totalled 9s. 6d. per share—a rate of distribution that has been maintained for the three preceding years. The company's wholly-owned subsidiary, Hume Steel South Africa (Proprietary) Ltd., has been able to expand production as a result of receiving an improved allocation of steel supplies.

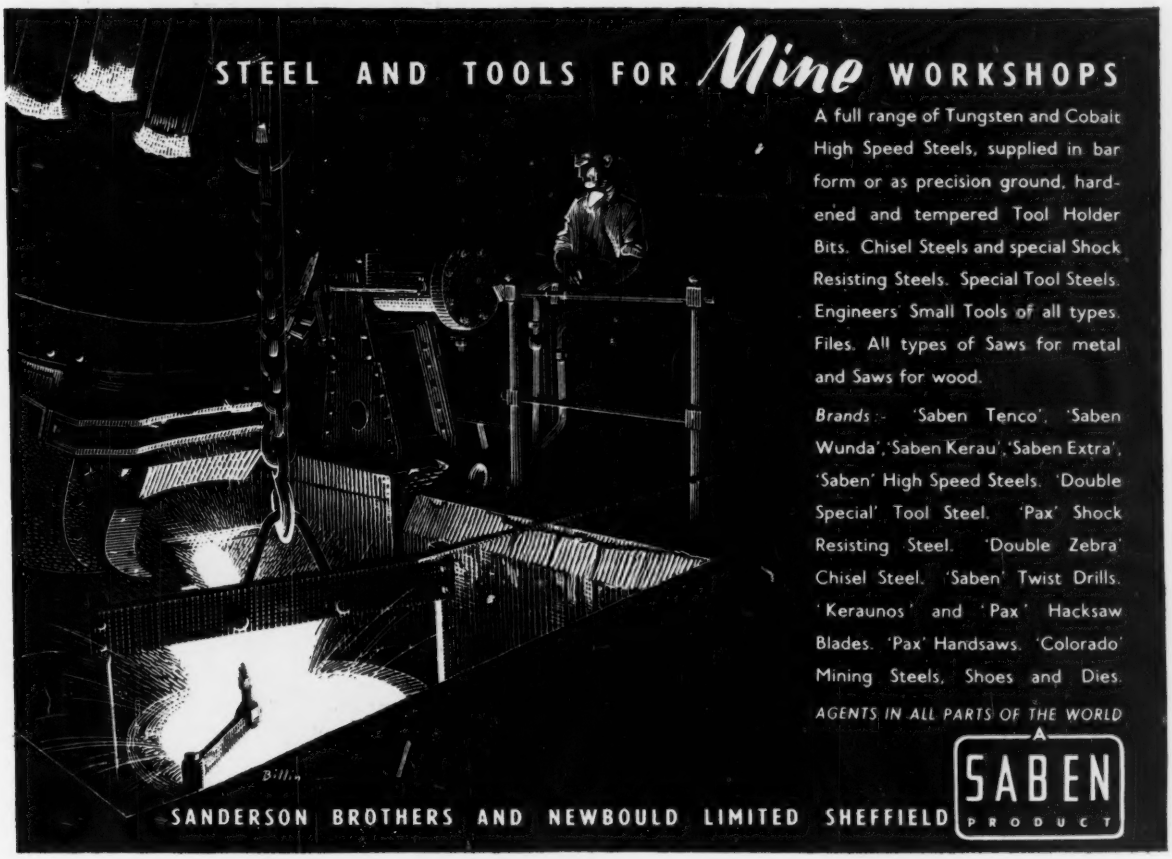
OIL INTERESTS

Trinidad Leaseholds Ltd.—Oil rights controlled by the Company cover some 134,000 acres in Trinidad. The major portion of production comes from the Forest Reserve area in the south west part of the island and which is some 22 miles from the refinery and shipping port at Pointe-à-Pierre with which the field is connected by pipeline.

For the year ended June 30, 1953, the consolidated net profit, after all charges, was £1,775,000 against £1,900,000 in 1952. Dividends declared rose 2d. to 1s. (free of tax) per 5s. stock unit and concurrently with the declaration of the final dividend in November, 1953, a one for one scrip issue was announced by the capitalization of £1,639,452 of the share premium account. The amount so capitalized represents cash already subscribed by stockholders and the doubling of the issued capital, so that it becomes £3,279,904, will have the effect of improving its relationship to the actual capital employed in the undertaking (£17,319,000 at June 30, 1953).

The Regent Oil Company, jointly owned by Trinidad Leaseholds and California Texas Company, is the marketing company for the products of T.L.L. and since the abandonment of the "Pool Petrol" arrangements in the U.K. in February, 1953, has achieved outstanding success with the motoring public with "Regent T.T."—its premium brand.

Recently, the company concluded an important contract for the supply of crude oil which will ensure the refinery being able to operate at maximum capacity for the next ten years.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Union Corporation Ltd.

THE Union Corporation is among the oldest of the large and influential mining-finance houses of South Africa, for its roots go back to an early period in the history of the Rand. It was registered in 1897 as A. Goerz and Co., by which name it continued to be known till 1918. Throughout its long life it has played an enterprising part in the mining and industrial development of South Africa and has also sought opportunities for profitable investment elsewhere in Africa and, in fact, throughout the world.

The Corporation's present substantial position rests on a wide and varied spread of selected assets including shares, debentures and other securities in gold, diamonds, base metal and chrome mines, real estate companies, industries, commercial undertakings, and companies engaged in prospecting and exploration.

Originally concerned solely with the mining industry in the Transvaal, the Corporation continues to be associated with some of the most successful gold producers on the Far East Rand. The Rand properties at present under its technical control are Geduld Proprietary, East Geduld, Grootvlei Proprietary, Marievale Consolidated and Van Dyk Consolidated.

The Corporation has long been in the vanguard of mining exploration and was among the early pioneers of the Orange Free State, where it had the distinction of bringing to production the first mine in the new gold field, St. Helena. It is also financially interested in two mines of great promise, which are among South Africa's youngest gold producers. These are Western Holdings—where values averaging 7,518 in. dwt. were recently obtained from development on the Basal Reef—and the Stilfontein Gold Mining Co. on the Far West Rand. Stilfontein's progress has been particularly rapid. Its average monthly crushings during the last quarter of 1953 reached 70,000 tons compared with an average of 65,000 tons per month over the whole year, and extensions to the reduction plant to increase crushing capacity to 90,000 tons per month are completed. Furthermore, Stilfontein recently announced its first profits from uranium production and is extending its leaching plant to treat the uranium-bearing slimes of four other mines.

The Corporation's other interests in the O.F.S. include mineral rights over several farms and investments in several undertakings now in the prospecting and development stage. Subsidiary companies are exploring an extensive area in the Bethal and adjoining districts of the Transvaal, about which little is known at present. Drilling by Capital Mining Areas has obtained some encouraging values in the Kimberley Reef.

By virtue of its holdings in Selection Trust, the Corporation is interested in the copper belt of Northern Rhodesia and the diamond wealth of Sierra Leone. Through the Tsumeb Corporation (in which Selection Trust is also interested) it has a substantial stake in base metal mining in South-West Africa. Its mining interests also include Chrome Mines of South Africa, which operates properties in the Rustenburg and Lydenburg districts of the Transvaal.

The Union Corporation has large interests in Mexican mining through its participation in San Francisco Mines of Mexico, which produces chiefly lead and zinc.

In the industrial field, the Corporation has substantial holdings in Bay Hall Trust, British Enka, and South African Pulp and Paper Industries. Bay Hall Trust was formed in 1934 to take over a number of industrial holdings. The book value of its investments at December 31, 1953, was £2,291,849 and their market value £2,742,797. A dividend of 7½ per cent, free of tax, was declared by this profitable subsidiary for 1953. British Enka is the well-known rayon manufacturer, which has spent large sums on modernization and expansion since the war. South African Pulp and Paper has also been engaged on a large programme of expansion, comprising the installation of additional paper machines at the Enstra Mill near Springs on the Far East Rand and the construction of the new Tugela mill in Natal.

For the year ended December 31, 1953, Union Corporation's earnings were £1,660,805 compared with £1,876,445 in 1952. Taxation called for £433,700 as against £818,300, and the net amount available was £1,227,105 compared with £1,058,145. After placing £600,000 (£400,000) to exploration reserve, the unchanged total dividend payment of 1s. 4d. per 2s. 6d. share or 53⅓ per cent, free of U.K. tax, called for £620,000 and the amount carried forward was £358,791, compared with £351,686.

GEDULD PROPRIETARY MINES

This Company's property is situated at Geduld, near Springs, on the Far East Rand. The mine has a fine record of profitable operation, having produced gold to the value of nearly £70,000,000 since crushing was started in 1908. In spite of the labour and power shortages experienced by Far East Rand producers generally, it milled 28,000 tons less in 1953 than during the preceding year. Though working costs rose by 4s. 1d. the profit per ton was only 1s. 1d. lower and the Company's earnings from all sources were sufficient to cover dividends totalling 57½ per cent compared with 62½ per cent in 1952. It is significant, however, that the grade of ore being milled has risen from 2.9 to 3.2 dwt., and at the end of the year payable ore reserves stood at 2,500,000 tons computed at 3.4 dwt. compared with 3,100,000 tons of the same estimated value as at December 31, 1952, and 3,500,000 tons at the end of 1951.

Surrounded by other producers the company has no opportunities for lateral expansion and the mine is now fully developed. Nevertheless, ore is still being opened up and areas formerly regarded as of little value are being worked. Development work is proceeding on the Black Reef, where 2,090 ft. sampled during the last quarter of 1953 showed a payability ratio of 24 per cent with an average value of 3.4 dwt. over 65 in. At the same time drilling is being carried out to explore the Kimberley Reef. At the present rate of crushing the developed ore reserves are sufficient for more than two years and doubtless the life of the mine will be extended by the systematic reclamation work now in progress. It is evident, however, that the future outlook has been adversely affected by the rising costs, which have rendered large tonnages unpayable.

Besides its own mine, the Company's assets include a holding of 3,308,425 stock units in East Geduld and 358,400 shares in Grootvlei Proprietary Mines. The dividend income from these sources has exceeded revenue from milling operations for some time.

EAST GEDULD MINES

This Company was formed in 1927 to explore the south-eastward extension of the Geduld shoots. Early expectations have been fully realized by the consistently satisfactory results of development. Values and widths have remained very constant and working costs are among the lowest on the Witwatersrand. The grade now being put through the mill is fractionally higher than in 1940 and is also above the average value for the reserves, which are equivalent to over seven years' milling and appear to be conservatively computed.

FINANCIAL RESULTS (*for the last two complete financial years*)

COMPANY (Year to Dec. 31)	ORDINARY SHARES IN ISSUE		PROFIT AND LOSS RESULTS £(000)										Capital Expenditure† £(000)		DIVIDENDS PER SHARE					
			Working Profit		Premium Revenue		Uranium Profit		Taxation and/or Mining Lease		Net Profit After Tax††				Paid					
															1953				1952	
			1953	1952	1953	1952	1953	1952	1953	1952	1953	1952	1953	1952	June s. d.	Dec. s. d.		June s. d.	Dec. s. d.	
East Geduld	9,000,000	(4/-)	3601·4	4111·9	82·8	162·5	—	—	1982·2	2313·7	1760·0	2029·4	155·4	176·2	1 9	1 9		2 0	2 1	
Geduld Prop.	1,460,857	(£1)	329·9	410·4	32·0	58·4	—	—	91·3	126·3	874·5	1058·7	34·6	156·1	5 9	5 9		6 3	6 3	
Grootvlei	11,438,816	(5/-)	2705·6	3215·9	82·9	159·7	—	—	1439·9	1759·4	1346·9	1616·5	57·1	184·5	1 2	1 1		1 3	1· 3	
Marievale	4,500,000	(10/-)	793·4	888·1	30·8	59·8	—	—	363·2	430·3	450·5	505·8	30·6	129·3	10	11		10	10	
St. Helena	9,625,000	(10/-)	303·8	86·3	26·6	37·0	—	—	—	—	261·5	79·1	225·8*	673·9‡	—	—		—	—	
Van Dyk	5,532,000	(10/-)	5·6	127·7	29·0	61·0	—	—	—	—	80·7	181·6	30·2	90·8	—	—		—	—	

†† Includes sundry revenue less sundry expenses
† Excluding Capital spent on Uranium production

* Including £163,795 spent on excess development
‡ Including £267,613 spent on excess development

Less footage was sampled in 1953, but the percentage payable and average value both showed increases. The payability of 79 per cent during the September quarter of last year was the highest for a long time, an average value of 281 in. dwt. being recorded. Still more encouraging were the results of the December quarter's development, which showed 81 per cent payability on the Main Reef and 43 per cent on Kimberley Reefs, with average value of 305 and 112 dwt. respectively.

The Company holds 537,600 stock units in the Grootvlei Proprietary Mines.

GROOTVLEI PROPRIETARY MINES

Grootvlei Proprietary Mines is the largest producer in the group and its developed ore reserves are the most extensive on the Rand, being approximately eight years ahead of the mill. The Company's property lies to the east of East Geduld and was considerably extended in 1941 by the acquisition of ground formerly belonging to Palmietkuil Proprietary on which were situated two fully-equipped shafts. Although much of this additional mining ground is probably outside the known payable ore shoots, the two shafts, together with two on the original property and a joint ventilation shaft near the common boundary of East Geduld, have proved very valuable in opening up the mine.

As will be seen from the table the tonnage milled last year was lower by 113,000 tons compared with 1952, and the mill grade fell slightly from 4.33 to 4.26 dwt. At 28s. 2d. the cost per ton, though it showed an appreciable increase, was still among the lowest on the Reef. Lower premium revenue and higher working costs were mainly responsible for a reduction of 587,184 in the working profit, which was reflected by dividends totalling 45 per cent against 50 per cent in 1952.

No change is recorded in the ore reserve position, compared with the preceding year. Mine developments continued to be satisfactory, although the footage was less and the pay ratio down to 45 per cent against 50 per cent in 1952. If the labour supply position continues to improve there is the likely prospect of an increased mill throughput during the current year.

VAN DYK CONSOLIDATED MINES

Van Dyk Consolidated Mines own an extensive property on the East Rand. In addition, the Government has agreed to lease to the Company the undermining rights of approximately 1,350 claims. When this agreement has been finalized the mining area will comprise 7,646 claims bounded on the east by Brakpan Mines and on the west by East Rand Proprietary.

Mining operations were never outstandingly successful in the northern area of the property. Since the war development has therefore been concentrated on the southern section, in which No. 5 shaft was sunk at an estimated cost of £1,250,000. Since the completion of this shaft in 1950, work has been directed to driving, mainly on the 48 level. Though development has given encouraging results, no definite conclusions can yet be drawn either from the values exposed or from the pay ratios. Folding and faulting have resulted in a large proportion of the footage driven being of an unpayable nature. In the June quarter, 1953, payability in this section was 38 per cent averaging 242 in. dwt., but the corresponding figures for the third quarter were appreciably lower at 34 per cent and 157 in. dwt. During the December quarter payability fell to 20 per cent but values improved again to 204 in. dwt. The payability of the total footage accomplished fell from 36 per cent in 1952 to 26 per cent last year, and at the end of the year ore reserves were lower by 200,000 tons. Stoping width increased by 1 in. and value by 0.2 dwt.

The opening up of the southern section has been financed entirely out of earnings and for this reason no dividends have been paid since 1947. Hopes that shareholders would eventually benefit from this policy received a set-back last year when a steep rise in working costs, together with smaller tonnage crushed and a drop of more than 50 per cent in the premium revenue, cut the working profit to £34,552 equivalent, to only 8d. per ton. A loss made during the third quarter of the year was offset by the sum of £46,231 recoverable from insurance relating to an underground fire in July.

MARIEVALE CONSOLIDATED MINES

Marievale Consolidated Mines was among the few gold producers on the Witwatersrand to increase its dividends during 1953, paying a total of 17½ per cent for the year against 16¾ per cent in 1952. This Company was incorporated in 1935 and is the only one so far to have successfully exploited the reefs on the extremity of the Far East Rand. The principal ore carrier is the Main Reef, but the Kimberley Reef is also providing satisfactory tonnages of payable ore. The north-westerly direction of the dip of the Main Reef gives the impression that it might eventually join up with the shoots coming from Vogelstruisbult and East Daggafontein. It is hoped, therefore, that rich shoots may be encountered in the north-western area.

The mill operated to capacity throughout last year and the increase in working costs amounted to 1s. 5d. per ton milled. Development continues to give good results with higher payability and values. Ore reserves are still being built up and currently stand about five years ahead of the mill.

ST. HELENA GOLD MINES

During its second full year of production, St. Helena Gold Mines continued to forge ahead and even at this early stage the results achieved are substantial enough to justify the faith by which the founders of this undertaking were inspired. As the first of the Orange Free State mines to be developed it has had many difficulties to overcome in the initial stages.

The company was incorporated early in 1946 and the incline shaft was started the same year. The first underground development result was announced in January, 1949, and the first gold bar was poured in October, 1951. The initial year's operations resulted in 598,000 tons of ore being milled for a yield of 4.0 dwt. per ton. The revenue was 50s. 8d. per ton and working costs amounted to 46s. 6d. per ton, resulting in a profit of 4s. 2d. per ton milled and a total working profit of £123,287.

Last year 799,000 tons were crushed for a yield of 4.1 dwt. per ton. Working costs per ton fell to 42s. 9d., resulting in a profit of 8s. 3d. per ton milled and a working profit for the year of £330,348.

While only 25,665 ft. were sampled last year, compared with 33,520 ft. in 1952, the average payability improved from 43 per cent to 53 per cent, and values from 312 to 325 in. dwt. The results from underground development on the Basal Reef improved progressively throughout the year 1953, and in respect of the March quarter 1954 as is shown by the following summary:

	Footage sampled	*Payability per cent*	*In. dwt.*
March quarter, 1953 ...	7,015	41	278
June quarter, 1953 ...	5,965	56	326
September quarter, 1953	6,745	58	318
December quarter, 1953	5,940	59	371
March quarter, 1954 ...	4,605	65	509

Working profits have also been rising steadily and reached £120,149 in the fourth quarter.

Payable ore reserves were increased during the year by no fewer than 750,000 tons. Recalculated as at December 31, 1953, they stood at the very satisfactory figure of 2,000,000 tons having an average assay value of 5.3 dwt. over an estimated stoping width of 51 in.

DEVELOPMENT AND MILLING RESULTS (*for the last two complete financial years*)

COMPANY (*Year to Dec. 31*)	*TOTAL ORES RESERVE As at last report*			*DEVELOPMENT RESULTS*						*MILL THROUGHPUT*													
				Ft. Sampled (000)		*Payability*				*Tonnage*				*Gold Recovered*						*Working Profit*			
						%		*Av. Value* (*In.-dwt.*)		*Milled* (000)		*Cost per Ton*		*Ounces* (000)		*Grade* (*dwt. per ton*)		*Cost per ounce*		*Per ton*		*Per oz.*	
	Tons (000)	*Value* (*dwt.*)	*In.-dwt.*	1953	1952	1953	1952	1953	1952	1953	1952	1953	1952	1953	1952	1953	1952	1953	1952	1953	1952	1953	1952
East Geduld	11,500	5·7	291	6·8	10·2	55	39	273	183	1,610	1,725	29/11	27/2	485·3	517·5	6·0	6·0	99/2	90/6	44/9	47/8	148/5	158/11
Geduld Prop.....	2,500	3·4	180	10·1	11·4	26	22	227	217	1,125	1,253	33/10	29/9	179·3	181·9	3·2	2·9	212/3	204/11	5/10	6/7	36/10	45/2
Grootvlei	16,000	4·6	218	34·1	37·4	45	50	211	211	2,203	2,316	28/2	26/2	469·2	501·7	4·2	4·3	132/4	121/-	24/7	27/9	115/4	128/2
Marievale	3,600	5·5	258	19·1	20·0	45	38	335	300	749	723	39/5	38/-	183·2	181·2	4·9	5·0	161/2	151/5	21/2	24/7	86/7	98/1
St. Helena	2,000	5·3	270	26·1	34·9	52	42	324	309	799	598	42/9	46/6	162·3	118·5	4·0	4·1	210/5	234/9	7/7	2/11	37/5	14/7
Van Dyk.....	1,300	3·7	155	22·3	28·4	26	36	229	228	1,022	1,246	41/-	34/8	169·4	183·6	3·3	2·9	247/2	235/4	1d.	2/1	7d.	13/11

†† Includes sundry revenue less sundry expenses
† Excluding Capital spent on Uranium production

* Including £163,795 spent on excess development
‡ Including £267,613 spent on excess development

Johannesburg Consolidated Investment Co. Ltd.

THE Johannesburg Consolidated Investment Co., Ltd., familiarly known in the markets as Johnnies, was formed in 1889, when the development of the Witwatersrand goldfields had just begun. In the face of keen competition it acquired a number of mining properties in the Far East and West Rand, and under its ægis some of the Transvaal's most famous gold mines have been brought to production, while through two of them, Randfontein Estates and East Champ d'Or, the group has a stake in South Africa's new uranium industry.

After more than half a century of progress and expansion Johnnies was no less quick to appreciate the potentialities of the new "Rand beyond the Vaal." It has been in the forefront of exploration and development in the O.F.S. and was the first company to claim ground around Odendaalsrus.

The interests of this far-sighted finance house are by no means confined to gold. Through its association with Mr. Barney I. Barnato, Johnnies acquired a substantial participation in the Kimberley diamond field, and its holding has grown with the expansion and prosperity of the diamond industry. The company was one of the early participants in the rich Copperbelt of Northern Rhodesia. It also ventured into platinum mining in the Transvaal at a time when the future of this metal was by no means assured. As a result of this prescience, it has a very large stake in the platinum industry, chiefly through its holdings in Potgietersrust Platinums, Ltd., a finance company holding approximately 43 per cent of the capital of the producing company Rustenburg Platinum Mines, Ltd. This latter company took over Union Platinum Mining and is engaged on a major scheme of expansion designed to bring the combined milling capacity of both mines up to 125,000 s.tons per month. A plant under construction at Rustenburg for the treatment of matte is expected to be completed by the middle of 1954. It will be controlled jointly by Rustenburg Platinum Mines and Johnson, Matthey and Co.

Johnnies has extensive coal mining interests, the group's principal collieries being Natal Cambrian Collieries Ltd., Phoenix Colliery Ltd., and Consolidated Collieries Ltd. Sales by the group's coal mines now amount to nearly 1,900,000 tons a year. It is also interested in lead and zinc mining in the United Kingdom through its wholly-owned subsidiary, Llanrwst Lead Mines Ltd., which controls The Abbeytown Mining Co. Ltd.

Like many other mining finance houses, Johnnies has not confined its activities to mining, but is also interested in a number of industrial ventures, among them being South African Breweries Ltd., and S.A. Carbide and By-Products Co., Ltd.

The magnitude of the company's operations is indicated by the profit before taxation for the year ended June 30, 1953, which amounted to £2,088,239, compared with £1,444,237 in the previous year. After charging taxation and adding £348,352 brought forward, the amount available for dividend and other appropriations was £1,541,683. A sum of £250,000 was transferred to investment reserve, which now stands at £1,446,514. In addition, there were appropriations of £500,000 to general reserve and £100,000 to provision for staff pension funds and voluntary allowances. A dividend of 3s. 6d. per share, equivalent to 17½ per cent, absorbed £380,187 net, leaving £311,496 to be carried forward.

Johnnies started its career with the modest capital of £175,000 which has been increased from time to time and now stands at £7,000,000 in £1 shares, of which 5,266,666 shares have been issued. In addition, £2,000,000 4½ per cent Unsecured Loan Stock have been issued. The company's quoted investments are shown in the balance sheet at June 30, 1953, at £8,687,229 but their market value at that date was £12,865,851. Both valuations include an amount of £1,969,224 for holdings of shares and loan stocks in Freddies North Lease Area Ltd., and Freddies South Lease Area Ltd. The loans to these two companies at June 30, 1953, amounted to £4,100,000 but they had been increased to £5,150,000 by November, 1953, by which time Johnnies had a total investment of approximately £7,100,000 in nearly equal proportions in the twin Freddies.

The financing of these two undertakings to their present stage of development has been a drain on the company's liquid resources to the point where further cash reserves were needed, alike for normal working capital requirements and to repay the £1,500,000 loaned by the De Beers Investment Trust Ltd. to the twin Freddies companies. These loans are repayable on or before December 31, 1954, and are guaranteed by Johnnies. To provide for these requirements the company decided to raise fresh funds of approximately £2,550,000 by a share issue. Accordingly, in December, 1953, shareholders were offered 1,316,666 shares of £1 each at 40s. per share, this offer being over-subscribed. It is considered that, under normal conditions, it will be possible to maintain the present rate of dividend on the increased capital. This will require a net amount of £506,916 subject, of course, to any alteration in the United Kingdom income tax rate.

EAST CHAMP D'OR

Future prospects for this small gold mine have been greatly improved by its acceptance as an uranium producer. Investigations indicated that the estimated tonnage of uranium-bearing ore was sufficiently great to justify exploitation, though not large enough to warrant the erection of a treatment plant by the company. Arrangements were therefore made whereby Randfontein Estates would extend its uranium plant and would accept uranium-bearing slimes pumped from East Champ d'Or. The treatment of slimes pumped to the Randfontein plant was started during March, 1954.

The company's entry into the list of uranium producers makes possible the exploitation of extensive tonnages of Bird Reef. It has been necessary, therefore, to carry out a development programme in this section, besides maintaining production in the existing sections of the mine. In view of the shortage of labour this has presented considerable difficulties. The tonnage milled is now considerably below the capacity of the reduction plant and current profits are being seriously affected.

Last year only 285,000 tons of ore were milled against 356,000 tons in 1952, while working costs rose by 5s. 6d. to 38s. 8d. As a result of these adverse factors the company made a loss from gold mining of £13,369 compared with a profit of £97,269 in the previous twelve months. In the same period the premium sales revenue declined from £17,517 to £7,886. Although the year's operations resulted in a net loss of £5,391, it was necessary to pursue this policy of preparing the Bird Reef for exploitation.

The production of uranium has involved modifications to underground and surface arrangements at the mine, besides the provision of plant for delivering uranium-bearing slimes to Randfontein. The capital expenditure required, estimated at £225,000, is being financed out of loans repayable over the ten-year period of the production agreement.

GOVERNMENT GOLD MINING AREAS

After more than forty years of successful operation, this famous Far East Rand producer is now earning lower profits, though consistently satisfactory results continue to be achieved. Owing to the gradual exhaustion of the Main Reef leader, the mine has become increasingly dependent on low-grade ore from the upper or hanging wall leaders, the Black Reef, reclamation on the Main Reef leader and the Kimberley Reef.

With a throughput of 2,952,000 tons last year the scale of operations was fully maintained, working costs increased by only 9d. to 29s. 11d. while the mill grade was fractionally higher. The profit from gold mining amounted to £561,065 against £607,276 in the previous year, but the revenue from premium sales fell from £120,581 to £66,863. Dividend payments aggregated 1s. 9d. compared with 2s. in 1952.

Though the footage accomplished in 1953 was only 21,226 ft., compared with 39,341 the previous year, the payability of 51.74 per cent averaging 245 in. dwt. can be regarded as satisfactory. At the end of the year the ore reserves were estimated at 7,024,000 tons, with an average value of 2.9 dwt. over 58 in.

A plant for the recovery of pyrite has been constructed on the company's property and was expected to be in production before June, 1954. A portion of the output will be made available to various producers of acid for use in uranium treatment plants. Approximately one-third of the total cost of this plant, estimated at £500,000, is being provided by the company out of its own resources and the remaining two-thirds through loans arranged by the United States and British authorities.

NEW STATE AREAS

New State Areas was formed in 1918 and has been milling continuously since 1923. As long ago as June, 1952, this company gave statutory notice of its intention to discontinue opera-

tions but with the assistance of premium revenue it was able to keep going throughout 1953. Mining operations ceased in February, 1954.

RANDFONTEIN ESTATES

Randfontein is one of the largest producers on the Rand and has one of the lowest milling grades. It will also occupy an important position in the South African uranium industry. In September, 1952, it was announced that by arrangement with the Atomic Energy Board of South Africa, the company would erect a plant for the extraction of uranium from the slimes arising from the treatment of ore from the Bird Reef which is not profitable to work for gold alone. In addition, a plant was to be erected on Randfontein's property for the production of sulphuric acid for use in connection with the production of uranium. The cost of the uranium and sulphuric acid plants and ancillary equipment, together with the cost of certain expenditure incurred underground in preparation for the mining of the Bird Reef, was estimated at approximately £3,780,000. This expenditure is being financed by a loan repayable during the period of the agreements to produce uranium and sulphuric acid.

In November, 1953, it was officially announced that the uranium project was to be expanded. The total cost of the uranium and acid project as now envisaged is estimated at more than £6,541,000. Sampling for uranium has brought to light further considerable tonnages of ore that, for their gold content alone, would not warrant extraction from the considerable depth at which they probably exist. This will have a marked effect on the life and future profits of the mine.

Returns from the company since preliminary operations were started at the uranium plant at the end of February clearly indicate the extent of the extra costs which are being incurred through the transfer of mining operations to the Bird Reef. This transfer entails the replacement of a certain proportion of tonnages previously mined and treated from other reefs by an equivalent tonnage of Bird Reef ore. However, since March, 1954, when a loss of £20,073 was reported in the monthly production return, much headway has been made and the return for April disclosed that a profit of £1,958 had been earned. This latter figure took in the most satisfactory maiden uranium revenue of £76,000 which represented the estimated valuation of uranium output after deduction of treatment costs and provision for interest and amortization of loans. This excellent uranium report has been well received by investors.

Future prospects for the mine are encouraging: for while it must be expected to become progressively more closely identified with uranium, it is also, however, in the favourable position of being a gold producer in its own right.

WITWATERSRAND GOLD MINING

Owing to the exhaustion of the available payable ore, mining operations at Witwatersrand Gold Mining were discontinued on November 26, 1953. Reclamation, dismantling, and sale of machinery and plant are proceeding.

Since it started operations in 1888, the company, which at present has an issued capital of £375,700, has produced some 6,445,000 oz. of gold, paid £4,838,000 in dividends, and provided £972,000 in lease and tax payments to the Government.

FREE STATE DEVELOPMENT CORPORATION

With an eye to the future, the directors of Johnnies sought an alternative outlet for the company's financial and technical resources in the Orange Free State. The Free State Development and Investment Corporation Ltd., more familiarly known as Freddies, was formed in 1944 to acquire the properties of the J.C.I. and its associates in the new field.

Freddies originally held option and participation rights over 360,900 morgen in various areas of the Free State, but the ground considered to be uneconomical was abandoned. The company's most valuable asset proved to be its option over mineral rights of 12,600 morgen surrounding and to the north of the township of Odendaalsrus. This area was subjected to intensive drilling for more than two years. A grid system of boreholes was laid out and it was established that practically the whole of the area was underlain by gold-bearing formation. This programme resulted in the formation of Freddies North Lease Area and Freddies South Lease Area. Each of these companies had an initial authorized capital of £5,400,000 in 10s. shares which, in each case, was subsequently increased to £6,500,000. The company's large shareholdings in the two Freddies constitute its major interest.

Freddies has a "Corridor" agreement with Odendaalsrus Gold, General Investments and Extensions (Oggies) and an arrangement with Freddies North and Freddies South in connection with land for township purposes. During the year ended March 31, 1953, Odendaalsrus Extension No. 2 (Ross Kent) Township was established by "Oggies" within a portion of the "Corridor." Portions of the farm Eva, comprising approximately 450 morgen, were transferred to "Oggies" during the year for a consideration amounting to £103,000, of which £28,000 was paid in cash and the balance of £75,000 by way of 300,000 full paid shares of 5s. each in the "Oggies" Company. In addition, Freddies was granted an option to purchase a further 300,000 shares in the "Oggies" Company at 5s. 6d. each.

Besides its holdings in Freddies North and Freddies South, the company owns shares in Harmony, Merriespruit and Virginia. The market value of its investments in these companies at March 31, 1953, was £1,651,297 compared with the book value of £1,033,178. The company also owns shares in "Oggies" and in a Co-operative concern.

FREDDIES NORTH, FREDDIES SOUTH AND FREDDIES CONSOLIDATED

The process of bringing Freddies North and Freddies South into production has been slow and arduous. Due to inflationary tendencies and to physical difficulties in respect of water and unstable strata, the cost of reaching the production stage has been far greater than was anticipated. Each property is being opened up by two shafts, which have been sunk to their final depth, and in each case a reduction plant of 50,000 tons capacity per month has been completed.

From the commencement of production in July to December 31, 1953, Freddies North crushed 150,000 tons for a recovery of 26,226 oz. (3.497 dwt. per ton) and Freddies South 172,000 tons, yielding 28,280 oz. (3.288 dwt. per ton). At Freddies North revenue from gold and silver (excluding premium sales) for the period July-December, 1953, amounted to £325,159 and working costs to £799,271. The comparable figures for Freddies South were £350,512 and £741,810.

The development footage accomplished during the year ended December 31, 1953, gave the following results:—

Footage Accomplished	*Footage on Reef*	*Footage Sampled*	*Footage Payable*	*Percentage Payable*	*Average Value (in. dwt.)*
*41,647	6,958	6,330	5,475	86.49	367
†42,859	9,213	8,520	5,905	69.31	308

*Freddies North †Freddies South

During the first quarter of 1954 the percentage payability at Freddies North, though still satisfactory, was somewhat below the average figure given above. At Freddies South, however, footage sampled during this quarter proved 80.08 per cent payable.

Under the conditions experienced at the two mines it has become apparent that operations cannot be conducted separately on an economic basis. It has, therefore, been recommended that an amalgamation of the two companies should be undertaken. The consequent combination of resources would be of great advantage, both financially and technically: costs would be reduced; while selective mining over a large claim area would ease many technical problems.

A scheme to effect these changes was announced in April last whereby a new company, Freddies Consolidated Mines, having an authorized capital of £17,500,000 in £1 shares, would take over the assets and liabilities (other than the 5 per cent loan stocks) of the two companies and would, in addition, issue to Freddies North and South 4,060,784 shares and 4,142,354 shares respectively at 25s. per share. The two companies would be placed in voluntary liquidation and their shareholders would receive, by way of distribution from the respective liquidators, one new £1 share in Freddies Consolidated for every three 10s. shares held in Freddies North and Freddies South. The outstanding loans—£3,500,000 in respect of each company—would be funded into Freddies Consolidated shares at 25s. per share. Loan stockholders of Freddies North and South would be offered the right to take payment for their stock at 102½ per cent or alternatively will be able to convert their holdings on the basis of 41 shares in Freddies Consolidated for every £50 of loan stock held. If these proposals are approved at the extraordinary meeting called for June 1, 1954, Freddies Consolidated will make a new share issue to its shareholders *pro rata* to their existing holdings at a price of 20s. per share which will provide an estimated net amount of £2,150,000. The issue has been underwritten.

General Mining & Finance Corporation Ltd.

IN a lot of ways 1936 is a long time ago, yet through all the changes, political and economic, that have taken place since that year, General Mining and Finance has maintained its dividend at 25 per cent. This is a very remarkable achievement for any company, but is especially noteworthy when it happens with a mining house subject to the vagaries associated with the industry.

The Corporation has been able to achieve this performance largely because of the quality of its investments; the portfolio now includes holdings in Blinkpoort Gold Syndicate, Crown Mines, Durban Roodepoort Deep, E. Rand Proprietary and Rand Mines. On the West Wits Line investments include Blyvooruitzicht, Doornfontein, West Driefontein and West Witwatersrand Areas. In addition to General Exploration Orange Free State, holdings in the O.F.S. include Free State Geduld, Harmony, Presidents Brand and Steyn, Virginia, and Western Holdings. The Corporation also has a majority interest in West Rand Consolidated, and provides the management for South Roodepoort Main Reef Areas. Apart from its subsidiary companies, which cover a wide section of industry, the Corporation has in addition a number of unquoted investments.

Of these companies, West Rand Consolidated continues to make mining history; it was the first of the leading Rand gold producers to become a producer of uranium on a large scale. Later it became the first to publish its monthly report in a manner which indicated how much profit was being made from uranium alone and how much from gold. Clearly monthly returns which omit any estimate of uranium profits lose a great deal of their value, and it would be surprising if, once the gold/uranium producers settle down to a more established routine, others do not follow in the steps of West Rand Consolidated by presenting information in a form as up-to-date as possible.

General Exploration Orange Free State ("Geoffries") is another important interest in General Mining's portfolio, for it is interested in the Van den Heeversrust area of the Free State where drilling has proved an extensive ore body containing gold-bearing reefs of a very satisfactory grade.

INCREASE IN ISSUED CAPITAL

During 1953, General Mining issued 274,440 Ordinary shares and 250,000 "B" Preference shares with the result that its issued capital is now £2,950,298 in 1,952,134 Ordinary shares of £1, 748,164 6 per cent Cumulative Convertible Redeemable "A" Preference shares of £1 and 250,000 6 per cent Cumulative "B" Preference shares of £1. This issue was the result of an offer of General Mining shares for shares in Consolidated Rand Investment and Trust Co., and in Transvaal Mining and Finance Co. Holders of Preference shares in Consolidated Rand Investment and Trust were offered an equal number of 6 per cent Cumulative "B" Preference shares in General Mining. Holders of Ordinary shares in Consolidated Rand Investment and Trust were offered Ordinary shares in General Mining on the basis of 7 General Mining shares for every 100 Ordinary shares held. Holders of Ordinary shares in Transvaal Mining and Finance were offered Ordinary shares in General Mining on the basis of 8½ shares in General Mining for every 100 shares held. The proposals caused a good deal of discussion in London but when the proposals were put formally at the extraordinary general meetings, they were passed with an overwhelming majority.

The second stage in the arrangement was the reduction of the capital of the two companies whose shares were acquired when all the legal formalities had been completed, Consolidated Rand Investment and Trust will have an issued capital of £40,366, all held by General Mining, and Transvaal Mining will have an issued capital of £11,625, also all held by General Mining.

Shareholders in both Consolidated Rand and Transvaal Mining will probably be pleased with their bargain, for the Preference shareholders of Consolidated Rand have the same coupon rate as before but a better cover for their dividend, and the Ordinary shareholders in Consolidated Rand and in Transvaal Mining have shared in the 25 per cent dividend paid by the company, whereas neither Consolidated Rand nor Transvaal Mining seemed likely to be able to resume the payment of Ordinary dividends for some years.

General Mining had a more successful year in 1953, its net profits amounting to £837,657, as compared with £582,217.

WEST RAND CONSOLIDATED MINES

West Rand Consolidated will occupy a distinguished place in the history of South African mining, for it was the first of the gold mining companies to become a uranium producer. Publication of information concerning some of the company's uranium activities have been banned. The ore reserves have been calculated without taking into account the Bird Reef series which carry the gold/uranium ore. Nevertheless, part of the picture is being revealed as time goes on, uranium profits have expanded from £124,707 in the last quarter of 1952 to £204,176 in the last quarter of 1953. The uranium profits on the first quarter of 1954 were £479,037. This amount cannot be compared with the sums mentioned earlier for at the end of 1953, a new method of compiling uranium profits was brought into use. Under this new method the last quarter of 1953 would have yielded £388,776 from uranium and not £204,176. This apparent leap in uranium profits is caused by a decision to transfer to gold production certain charges which had been hitherto made against uranium. The reasons underlying this change in practice have not been revealed, and to a certain degree they do not matter since the mine has to be considered as a whole.

Year to Dec. 31	*Gold*	*Other Minerals*	*Mining Costs*	*Uranium**	*Dividend*	*Tax*
	£	£	£	£	%	£
1953†	4,587,948	61,269	4,225,832	1,367,998	37½	467,666
1952	5,102,195	78,069	3,614,178	124,707	30	351,190
1951	5,261,051	83,408	3,276,607	Nil	30	800,504

† Calculated on new basis.

In 1953, revenue from the sale of the various non-uranium minerals sold fell by £531,047 to £4,649,217, the main reasons for this contraction being a drop in the grade of ore treated from 3.05 dwt. to 2.76 dwt. and a decline in the revenue received from sales of gold on the premium markets. At the same time working expenditure rose by £611,654, thereby contracting working profits from gold by £1,142,701. This is only half the story, however, for the fall in the grade of ore has been caused by treating the Bird Reef series which carries a low gold content, but has the uranium too.

Year to Dec. 31	*Tons milled*	*Value*	*Working Costs per ton*	*Development Excl. Bird Reef*	*Development Bird Reef*	*Ore Reserves* Tons*	*Ore Reserves* Grade*
	(000)	*dwt.*	*s.*	*ft.*	*ft.*	*(000)*	*dwt.*
1953	2,651	2.76	31.91	46,331	49,745	6,600	3.3
1952	2,624	3.05	27.58	49,150	38,644	6,800	3.4
1951	2,537	3.18	25.87	51,178	25,866	7,812	3.4

* Excluding shaft pillars and Bird Reef series.

In 1953, uranium brought in net profits of £1,367,998 (1952, £124,707) subject to adjustments; the nature of these adjustments has not been disclosed, but the directors' report states that these adjustments will not be material in relation to the profit figure mentioned above. When the two sides of the company's activities are combined it will be seen that profits show an increase over the previous year of £112,473. The company has received another advantage besides the not unsatisfactory expansion of £112,473 in profits, i.e. as stated earlier, the grade treated has been lowered considerably and this will enable the mine to continue working for a good deal longer than it would otherwise have done. Dividends paid during 1953 were bigger at 37½ per cent than in the previous two years.

Up to the end of 1953, a total of £1,778,852 (including loan interest) had been spent on the construction of the uranium extraction plant, the bulk having been spent in 1952. It seems that the company had undertaken to hit a production target and it has been decided that the best way of doing this would be to extend the uranium plant at a cost of £550,000. Application has been made for increased loan facilities to cover this expenditure. The expanded programme, according to present estimates, will be completed and in full production by the end of 1954. Already the first unit was reckoned to be in full production from January 1, 1954, the significance of this being that loan repayments in respect of this unit must start from that date. The annual amount involved is £217,242. Capital expenditure on gold account amounted to £216,193.

Ore reserves excluding the Bird Reef series amounted to 6,600,000 tons of an average grade of 3.3 dwt. as compared with 6,800,000 tons of an average grade of 3.4 dwt., but as a vast amount of development has taken place on the Bird Reef series—49,745 ft. having been accomplished during 1953—the real ore reserves would appear to be much higher.

SOUTH ROODEPOORT MAIN REEF AREAS

At the end of June, 1953, South Roodepoort Main Reef Areas held a mining area consisting of 2,084 claims, small by normal Rand standards, lying to the east of Randfontein Estates property and to the south-west of Durban Roodepoort Deep, but touching neither property. The company's mining rights are in respect of the Contact Reef and any other reefs in the Elsburg series. The right to mine other reefs is subject to agreements with Johannesburg Consolidated Investment. Application for a mining lease over portions of farm Luipaardsvlei 30 and farm Rietvlei 9 has been made and is expected to be granted soon.

Year to June 30	*Revenue (gold, etc.)*	*Working Profits*	*Capital Expenditure*	*Tax*	*Dividend*	*Carry Forward*
	£	£	£	£	%	£
1953	935,153	295,574	28,698	139,509	15	125,342
1952	936,941	299,471	43,399	150,874	15	109,419
1951	932,075	307,059	29,126	150,877	15	109,084

Results for the year to June 30, 1953, differed only slightly from those of the year before. The amount treated was lower by 1,000 tons, but an improvement in the grade raised the number of ounces of gold recovered from 72,572 to 73,708. Despite the falling off in premium revenue, gold realized very little less than in 1951-52, and costs kept steady, rising only from £637,470 to £639,579. The dividend was maintained at 15 per cent, the rate paid for the previous two years.

Year to June 30	*Tons Milled*	*Grade dwt.*	*Development ft.*	*Payability*	*Ore Reserves tons*	*dwt.*
1953	324,000	4.55	31,041	34.6%	1,070,000	4.7
1952	325,000	4.47	28,769	37.9%	1,110,000	4.6
1951	321,000	4.48	22,148	48.4%	1,121,000	4.6

As a result of the mine being declared a controlled registered mine in terms of the Silicosis Act, the company appears to be liable for a contribution of £23,004 to the Silicosis Fund for the past and to make current payments.

Development results in the central section of the mine do not differ gr atly from those of previous years and the Rietvalei section continues to give satisfactory values. Since the end of 1952-53, improved results have been reported on farm Vlakfontein No. 14. The only disappointment has come from the southern section on farm Luipaardsvlei No. 30.

GENERAL EXPLORATION ORANGE FREE STATE LTD.

General Exploration Orange Free State, or to give the company the name by which it is most familiar "Geoffries," has largely fulfilled the objects for which it was formed. It was established under the ægis of the General Mining and Finance Corporation to explore and test the mineral potentialities of various areas held under option contracts with a view to turning these and sundry participating rights to account.

At the start of the company's career very large prospecting areas were held. Unpromising areas have since been abandoned and other farms acquired with the result that the company has now an exceedingly interesting selection of ground on which drilling has been carried out. The next stage will be the flotation of at least one and probably two mining companies to develop this ground, but this flotation is not being hastened at this juncture. The developing mines of the O.F.S. are coming into production, but until production has settled down and the shareholders are ready to take on further responsibilities, flotation of new companies is hanging fire.

"Geoffries" main properties are centred to the north-west of the town of Odendaalsrus and include the freehold title of the farms Spes Bona, Rosedale, Weltevreden and Welgevonden, covering approximately 2,650 morgen. It holds mineral rights in the Hoopstad, Kroonstad, Ventersburg, and Winburg districts, over a total area of 2,514 morgen. In addition, it has participation rights in net vendor consideration and subscription rights over an area of roughly 2,900 morgen in the Hoopstad, Kroonstad and Ventersburg districts.

Probably the most important of these interests is the freehold over the four farms already mentioned. Contiguous to some of these farms lie farms held by Middle Witwatersrand Areas—farms Kleinbegin, Britzpan, Van den Heeversrust, and Stephanus Rust. All these eight farms have been put into one pool in which Middle Wits, "Geoffries" and Anglo Transvaal Consolidated have an interest. In the event of an application being made to the Mining Leases Board for a lease, the first company formed to exploit the area or any part of it would be under the control of Anglo Transvaal.

Subject to existing rights "Geoffries" and Middle Witwatersrand (Western Areas) Ltd. will participate in the vendors and subscription rights of this company *pro rata* to the estimated payable tonnage contributed by each company provided that Middle Witwatersrand (Western Areas) Ltd. receive a minimum of 25 per cent vendors and 25 per cent subscription rights in respect of this first mining area. Any areas referred to above not included in the first lease shall be under the administration of General Mining and Finance Corporation Ltd., and vendors and subscription rights shall be based *pro rata* to the estimated payable tonnage contributed by the participants.

This somewhat novel method is the consequence of the thick reefs of the type indicated in the "Rainbow" formation causing the value of such reefs to vary to a far greater degree than with the more normal Basal and Leader Reefs. The task of calculating the possible worth of the potential mine and the participations cannot be settled until actual mining begins.

STAGES IN THE DRILLING PROGRAMME

Broadly speaking, the area was drilled in two stages: firstly, to discover the length of strike of the reefs discovered during the early stages of the drilling programme, and secondly, to ascertain their lateral extent. A borehole VDH1 on farm Van den Heeversrust intersected a series of gold bearing bands which could not be correlated to the Basal or Leader reefs and indeed, these reefs were later cut in the same borehole. The series, later to be called the "Rainbow" reefs, occurred in this borehole at a depth of between 4,690 ft. and 5,304 ft., giving values of up to 1,652 in. dwt. Later about 14,000 ft. to the north-west of VDH1, a borehole K1 on farm Kroomdraai intersected the gold bearing series, with less spectacular results. Nevertheless, the highest band assayed 554 in. dwt. and deeper down the Leader-Basal reefs were intersected. To discover whether any correlation between these reefs existed, borehole TV2 was sunk on farm Te Vrede, about halfway between VDH1 and K1. Once again the "Rainbow" reefs were intersected and values of 5,306 in. dwt. and 4,052 in. dwt. were exposed between 4,776 ft. and 5,652 ft. Some 7,000 ft. to the south-east of VDH1 a borehole RD1 on farm Rosedale was sunk and three gold bands in the upper series were revealed, the highest value being 1,439 in. dwt. Another 3,000 ft. to the south-east of RD1 another borehole was sunk, ERK1, and on this occasion two bands in the upper reefs series were intersected, the highest value being 1,005 in. dwt. Thus, a line appears to run across the "Geoffries" property from K1 to ERK1, a distance of 24,000 ft.

The rest of the extensive drilling programme was concerned with trying to ascertain how far east and west of the line the "Rainbow" and other reefs extend. To the west of the line, two boreholes have given very satisfactory results. Roughly half-way between VDH1 and TV2, and roughly 500 ft. from the line, borehole TV3 intersected the "Rainbow" reef with a top value of 4,118 in. dwt. and with six values, any one of which would be considered payable. Approximately half-way between VDH1 and RD1 and again about 500 ft. from the line, borehole RD2 cut the multiple reefs with values up to 830 in. dwt. On the eastern side of the line, VDH5, about 500 ft. north-east of VDH1, was successful in finding multiple reefs, but the values were not very high, although lower down values of 535 in. dwt. were found on the A reef and 3,130 in. dwt. in the Basal reef. The remaining holes on this side of the line have either failed to find the upper multiple reefs or the values were negligible, but that term cannot be applied to the values found in these holes for the other reefs. Thus a deflection in borehole Spes Bona 1 gave 259 in. dwt. in the Basal reef and in VDH3, the Basal reef returned 237 in. dwt.

Considerable portions of the farms Spes Bona, Welgevonden and Weltevreden have been proved to be underlain by coal horizons. Although the existence of coal in the Free State has been known for many years, "Geoffries" is the most prominent of all the companies working in the field to have intersected seams. The various holes which have been sunk in this area have given a calorific value of interest but sufficient work has not yet been done to determine the extent of the coal area. Analysis of the coal samples—depth and thickness of the seams—show the occurrences on Weltevreden to be economical.

The amounts shown in "Geoffries" profit and loss account for the year to December 31, 1953, are quite nominal, reflecting the period of waiting mentioned above. The balance sheet reveals one change of note; the company has sold some of its investments and has increased the amount of cash available by £252,004 to £568,330, debtors stood in the books at £3,966 and creditors at the very small sum of £246. The realization of part of investment portfolio brought in the handsome profit of £112,348 which has been transferred direct to the general reserve, which after debiting the balance from the income and expenditure account, amounted to £505,415.

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Anglo-Transvaal Consolidated Investment Co. Ltd.

A STRIKING example of the part played by the great mining finance houses in the economic development of Southern Africa is afforded by the activities of the Anglo-Transvaal Consolidated Investment Co. Ltd. Registered in the Transvaal in June, 1933, with the immediate object of sponsoring Rand Leases (Vogelstruisfontein) Gold Mining Co. Ltd., the company now has wide mining, industrial and commercial interests.

Anglovaal administers more than thirty companies, either as secretaries or consulting engineers or in both capacities. At June 30, 1953, the book value of its quoted investments in subsidiary and other companies was £5,300,000 with a corresponding market value of £4,400,000, while unquoted investments amounted to £698,000 at cost or directors' valuation, whichever was the lower. There is a specific provision of £600,000 against the whole of the investment portfolio other than the subsidiary companies, and, in addition, the company's revenue reserves amount to £3,900,000. For the year ended June 30, 1953, Anglovaal made a profit of £592,700, after allowing for taxation of £138,000 and writing off £34,200 in respect of shares and interests in other concerns. Dividends amounting to 50 per cent absorbed £381,250 and £33,000 was distributed to holders of Preference Shares, leaving £401,600 to be carried forward. For the same year the dividends declared by Anglovaal and the principal companies under its administration totalled £232,194 on Preference Shares and £2,352,153 on Ordinary Shares.

RAND LEASES

Rand Leases (Vogelstruisfontein) is situated near Roodepoort on the West Rand. In common with other Rand producers, this well-known mining company has been adversely affected by a shortage of native labour for underground work, with a consequent fall in the tonnage milled which, together with increased costs, has reduced the working profit to a low level. In addition, there has been a sharp decline in the premium revenue and as a result the interim dividend in December, 1953, was reduced to 3d. compared with 1s. in December, 1952.

Technically, however, the mine is in a very strong position. At June 30, 1953, the fully developed ore reserve on Main Reef series was estimated at 3,772,000 tons, having an average value of 4.42 dwt. over a stoping width of 42.3 in., which is well above the current milling grade of 3.5 dwt. Development continues to show satisfactory payability and values and shareholders should derive future benefits from the extensive capital expenditure programme now in progress.

Other established gold producers in the Anglovaal Group are Village Main Reef Gold Mining (1934) Ltd., and Eastern Transvaal Consolidated Mines Ltd.

"SAND RIVER BLOCK"

Anglovaal controls the Virginia and Merriespruit gold mines situated at the south-eastern extremity of the Orange Free State goldfields. These two mines, together with the adjacent Harmony Gold Mine—on the board of which Anglovaal is also represented—constitute the "Sand River Block."

Virginia and Merriespruit were both formed with an authorized capital of £2,562,500, divided into 10,250,000 units of stock each of 5s., of which 9,000,000 have been issued. In each case £2,000,000 of first mortgage debentures were issued. Kennecott Copper Corporation subscribed firm for 2,250,000 units of the 5s. stock in both companies. In addition, Kennecott underwrote the whole of the debenture issue for Virginia and also subscribed firm for £500,000 of Merriespruit debentures, underwriting the remaining £1,500,000 balance. This was the first occasion on which large-scale American capital participated directly in the equity of a South African mining venture.

The adjacent position of the Virginia and Merriespruit properties has allowed a plan of conjoint operation to be followed. Services are shared and equipment and methods have been standardized wherever possible.

At Virginia the initial shaft sinking programme has been completed. Since the commencement of development operations up to the end of September, 1953, a total of 37,893 ft. of development had been accomplished, of which 15,966 ft. were on reef. Of 7,485 ft. sampled, 47.2 per cent proved payable with an average value of 8.06 dwt. over 36 in., equivalent to 290 in. dwt. During the last quarter of 1953, 3,685 ft. were sampled and 63.6 per cent proved payable with an average value of 275 in. dwt. It is expected that production at an initial capacity of 50,000 tons monthly will be reached early in 1954. Capacity will immediately be increased to 75,000 tons monthly and subsequently by stages to 125,000 tons. By arrangement with the Atomic Energy Board of South Africa, Virginia is erecting plants to extract uranium and to produce sulphuric acid for the supply of its own acid requirements and those of certain other mining companies. It is expected that the sulphuric acid plant will be ready for operation by the middle of 1954 and the uranium plant early in 1955.

At Merriespruit, No. 1 shaft has been sunk to a depth of 3,771 ft. on Basal Reef. Development on level 35 was started on April 15, 1953, and was continued until September 14, when it was suspended to install the permanent shaft equipment. During this period a total of 2,718 ft. was accomplished; 1,535 ft. sampled disclosed 62.9 per cent payability, averaging 6.22 dwt. over 48.4 in., equivalent to 301 in. dwt.

The Kennecott Copper Corporation has agreed to provide additional funds of £5,000,000 in order to bring Merriespruit to production at a milling rate of 75,000 tons a month. The capital of the company has accordingly been increased by the creation of £5,000,000 3 per cent Registered Unsecured Redeemable Loan Stock. Kennecott has subscribed firm for £3,000,000 of this loan stock for cash at par and will subscribe for £2,000,000 on February 1, 1955.

"MIDDLE WITS"

Through Middle Witwatersrand (Western Areas) Ltd., the Anglovaal Group is substantially interested in Hartebeestfontein Gold Mining Co., Ltd., which was formed in 1952 to mine an area in the Klerksdorp district.

"Middle Wits" retains its interests in mineral rights in the Virginia and Odendaalsrus districts of the Orange Free State and in the Klerksdorp district. It will receive a substantial participation in the share issue on flotation of the Buffelsfontein Gold Mining Co., Ltd., adjoining Hartebeestfontein. Drilling is currently in progress in the Klerksdorp Townlands and has indicated that this portion of the Townlands has good prospects of contributing a substantial area towards a future mine.

Virginia Land and Estate Co., Ltd., has been formed by Middle Wits to develop a township in the Virginia-Harmony area. Applications for the establishment of five townships are at present under consideration by the O.F.S. Township Board.

BASE MINERAL INTERESTS

Situated in the North Eastern Transvaal, Consolidated Murchison is the world's richest antimony mine. Last year Consolidated Murchison made a loss of £46,792 in the September quarter, against a profit of £134,140 for the June quarter, but during the December quarter a profit of £70,433 was recorded, bringing the estimated total for 1953 to £285,684.

Anglovaal is also substantially interested in the Associated Manganese Mines of S.A., Ltd., whose operations for the year 1952 resulted in a profit, before taxation, of £1,045,667.

Through West African Aluminium the group is associated with the developments in West Africa which have given rise to the Volta River scheme for the production of aluminium in the sterling area.

COAL AND INDUSTRIAL INTERESTS

The group's extensive coal mining interests are administered through Anglo-Transvaal Collieries Ltd., whose producing collieries had a combined sales output of 1,036,539 tons for the year ended June 30, 1953.

The South African Torbanite Mining and Refining Co., Ltd. (Satmar), successfully established an oil-from-shale industry at Ermelo in the Transvaal. The crude shale oil produced is transported to Boksburg, where it is refined. Two other members of the group, Angb-Alpha Cement Ltd., and Union Lime Co., Ltd., are among South Africa's largest producers of cement and lime respectively.

Finally, Anglo-Transvaal Industries Ltd. is interested in a number of leading South African industrial companies, whose activities cover an extremely wide and varied field. The profits earned by this company in the year ended June 30, 1953, amounted to £301,381.

Strathmore Consolidated Investments Ltd.

THE Strathmore group is the youngest of the Rand mining groups and derives its present name from the farm Strathmore 15, in the Klerksdorp district of the Western Transvaal, where the only known outcrop of Vaal Reef occurs. This small outcrop was first discovered in the late 1880's. The prospecting results were satisfactory and a 5-stamp battery was erected by the late Mr. Thomas Leask, then owner of the farm. The property was floated by various mining companies, but without much success.

Shortly before the end of the century the late Mr. Charles Scott, after protracted investigations in the Klerksdorp district, invested all his savings in the purchase of the farm Strathmore. He spent the rest of his life in attempting to open up this property, but without success, since all the work done showed faulted conditions and limited patches of reef. In 1929 he was joined by his son, Mr. Jack Scott, by whom his pioneering activities have been carried on. The Scotts spent much time and money searching for the continuation of the Strathmore Reef, but the quest was a difficult one because the stratigraphic horizon was unknown. For many years the results of prospecting and drilling proved disappointing, and it was not till after the second world war that the perseverance of the Scott family and of the Strathmore group of companies were rewarded by discoveries of the Vaal Reef in payable quantities in an area which had been repeatedly investigated and abandoned.

Strathmore Consolidated Investments Ltd.—pioneer company of the group—was incorporated in 1899 as Kleinfontein Estates and Township Ltd., but changed its name to the present one in 1949. As a result of the faith of its founders in the potentialities of the Klerksdorp district, it is to-day entrusted with the technical and administrative control of four gold mining companies; namely, Stilfontein Gold Mining Co. Ltd., Buffelsfontein Gold Mining Co. Ltd., Ellaton Gold Mining Co. Ltd., and Babrosco Mines Ltd.

Together with Eastern Rand Extensions, Stilfontein holds approximately 60 per cent of the issued capital of the Ellaton Gold Mining Co. Ltd., which started production in January, 1954. Both the Ellaton and Babrosco Mines have been admitted as uranium producers under a joint scheme whereby the uranium-bearing slimes, together with those from other mines in the district, will be pumped for treatment to the extended leach plant at Stilfontein.

In addition to its shareholding in the group companies, Strathmore Consolidated has a substantial interest in Hartebeestfontein Gold Mining Co. Ltd. Through a wholly-owned subsidiary it continues to hold an approximately one-third interest in the mineral rights of the eastern portion of the farm Townlands of Klerksdorp, which are held by the Middle Witwatersrand (Western Areas) Ltd.

The company's principal interests outside South Africa are in Southern Rhodesia, where Strathmore Consolidated controls the Sun Yet Sen Gold Mining Co. Ltd., Hopefield Gold Mining Co. Ltd., Glenara Estates Ltd., and Kenilworth Estates Ltd.

STILFONTEIN GOLD MINING CO. LTD.

In 1933, Western Reefs Exploration and Development Co. Ltd. was formed to investigate a large area in the Klerksdorp district. It held under option 112,742 morgen in and around Klerksdorp, including the farms Stilfontein 39 and Hartebeestfontein 41. By the end of 1953 this company had geologically mapped and prospected by geophysics and drilling a large portion of the area. The results were mainly disappointing and the Stilfontein area was accordingly abandoned. On the farms Nooitgedacht and Witkop, however, good borehole values led to the establishment of the Western Reefs mine.

During 1942, option contracts over a block of farms in the Klerksdorp district were secured by Mr. J. R. T. Leask of Klerksdorp in association with Monarch Cinnabar (Pty.) Ltd. and Strathmore Exploration and Management Ltd. These options covered the greater part of what is now known as the "Lucas Block," as well as Stilfontein 39.

After various attempts to interest mining houses had proved unsuccessful, the options were eventually taken over by Alpha Free State Holdings Ltd., but in 1946 this company ceded the greater part of its interest to Middle Witwatersrand (Western Areas) Ltd.

Shortly after the war, Middle Witwatersrand became interested in the economic possibilities of the Klerksdorp Townlands. Mr. Jack Scott anticipated that the Strathmore Reef would extend into the Townlands, although previous attempts to locate it had proved unsuccessful. An extensive drilling campaign was started by the Strathmore Gold Mining Co. Ltd., a newly formed member of the Anglo Transvaal group, in which Eastern Rand Extensions (a company associated with Strathmore Exploration and Management) had a 45 per cent participation, but the results indicated that the Strathmore Reef was not present on the Townlands. Drilling proved, however, that it was the same reef as the Vaal Reef, which was being investigated on the adjoining farms Vaalkop and Zandpan by the Vaal Reef Exploration and Development Co. Furthermore, this drilling indicated that the reef occurred in the upper part of the Main Bird Series.

On Mr. Scott's return from active service in 1945, he obtained options over Stilfontein 39 and the adjoining farms Rietfontein and portions of Palmietfontein. These farms were the only ones not then under option and offered the last chance of locating the Strathmore Reef. A geophysical survey undertaken by Middle Witwatersrand had indicated an area on Stilfontein where the depth of lava would possibly not be great. The first borehole, started in July, 1947, intersected Vaal Reef at a depth of 2,637 ft., assaying 101 in. dwt. Three more boreholes gave payable results and a large-scale drilling programme was started.

Funds for the acquisition of the options and for the drilling programme were provided by members of the Strathmore group of companies; namely, New Pioneer Central Rand Gold Mining Co., Eastern Rand Extensions, and Southern Van Ryn Reef Gold Mining Co. These three companies held 60 per cent, 15 per cent and 15 per cent interests respectively in the area and the Strathmore Company 10 per cent.

Stilfontein's progress has been as rapid as it has been satisfactory. During the year ended December 31, 1953, 780,000 tons were milled and the working profit reached the record total of £1,146,540. The monthly tonnage crushed increased steadily throughout the year to a peak of 72,000 tons in December.

The total footage developed on the Vaal Reef during the year amounted to 18,939 ft. Of 18,815 ft. sampled, 80.1 per cent proved payable with an average value of 363 in. dwt.

The ore reserves, recalculated at December 31, 1953, amounted to 2,270,000 tons with a value of 7.50 dwt. per ton over a stoping width of 36 in.

During the latter part of the year, the uranium plant was put into operation. The profit derived from uranium for the initial months of production up to the end of 1953 was £44,833, subject to adjustment. The plant is being extended to treat uranium-bearing slimes which will be pumped from Ellaton, Babrosco, Afrikander Lease and New Klerksdorp Gold Estates, all these mines being situated in the Klerksdorp district. The extensions were scheduled for completion about mid-1954.

THE LUCAS BLOCK

The reconnaissance geophysical survey carried out by Middle Witwatersrand in 1946, besides indicating that on the farm Stilfontein 39, north of the Lucas Block, the thickness of lava would possibly not be great, also indicated a further area in the central portion of the farm Hartebeestfontein where the thickness of lava would be small. Middle Witwatersrand commenced a borehole (HB.1) in this anomolous area in September, 1947. The borehole was completed in October, 1948, at a depth of 6,620 ft. without intersecting Vaal Reef. The general opinion at this stage, based on information available from Stilfontein and from drilling on the farms Zandpan and Modderfontein, was that the Vaal Reef, if present over the greater part of the Lucas Block, would be too deep to justify further exploration.

While borehole HB.1 was being drilled, information obtained from drilling results on Stilfontein indicated that the flotation of a large-scale mining proposition on the farm Stilfontein would necessitate the incorporation of the northern portion of the farm Hartebeestfontein, known from the drilling on Stilfontein to be underlain by Vaal Reef at a workable depth, into the proposed lease area. An agreement was therefore entered into between the Strathmore companies and Middle Witwatersrand, which contained the following provisions:

(a) the Strathmore companies were to explore the Lucas Block area at their own expense;

(b) the technical control of the Lucas Block would be in

the hands of the Strathmore companies until such time as the Stilfontein lease area was defined and accepted by the Mining Leases Board, after which technical control would revert to Middle Witwatersrand;

(c) up to a maximum of 1,000 claims on Hartebeestfontein were to be included in the Stilfontein lease area. In return, Middle Witwatersrand received a 7½ per cent interest in the Stilfontein company and the Strathmore group acquired a 50 per cent interest in the Lucas Block.

In January, 1949, the Strathmore group acquired control of Alpha Free State, which at that time had a 20 per cent interest in the Lucas Block. Under this agreement the above interest was automatically reduced to 10 per cent.

The mineral rights of the Lucas Block acquired by the Strathmore companies were registered in the name of Strathmore Development Co. Ltd., a wholly-owned subsidiary of New Pioneer, during 1950.

On completion of the agreement, the Strathmore companies started drilling borehole HB.5, which intersected payable Vaal Reef at a depth of 2,736 ft.; this led to a thorough investigation of the area by a drilling programme, which was completed in 1952. The evidence so obtained indicated that the amount of workable reef on the Lucas Block would be too little to accommodate two mines, but that by inclusion of contiguous ground, an area sufficient for two mines would be available.

Further agreements were therefore entered into, whereby:

(a) Stilfontein would re-cede to the company formed to mine the northern portion of the Lucas Block, 300 claims in return for £5,450 cash and the right to subscribe at par for 40,000 shares in the initial issued share capital of Hartebeestfontein Gold Mining Co. Ltd.;

(b) Anglo American agreed to loan to the companies formed to work the lease areas in the Lucas Block the sum of £2,500,000 in return for participation rights amounting to 25 per cent of the share capital.

(c) Vaal Reefs agreed to cede the remaining 300 morgen of the farm Zandpan 43 for incorporation in the future lease area of Hartebeestfontein in return for a 7 per cent participation.

As a result of these arrangements, the Strathmore companies have a 43.3 per cent participation in Hartebeestfontein, of which 21.5 per cent is held by New Pioneer and the balance by Alpha Free State, Eastern Rand Extensions, Southern Van Ryn, Strathmore Exploration and Stilfontein, in varying proportions. The same companies hold 47.5 per cent of the shares of the Buffelsfontein Gold Mining Co. Ltd., New Pioneer's holding being 24.4 per cent.

The discovery of the Vaal Reef at workable depths on the Lucas Block and adjoining areas in sufficient extent to warrant the formation of two mines to exploit the area, can be attributed primarily to the initiative of the Strathmore group.

BUFFELSFONTEIN GOLD MINING CO. LTD.

This company has obtained a mining lease over 4,889 claims, being the southern portion of the Lucas Block, between the Hartebeestfontein Mine and the Vaal River. The initial capital was provided by the issue of 4,000,000 shares of 5s. each, of which 1,000,000 shares were subscribed for by Anglo American at 8s. per share and the balance by the various interested companies at par. As previously stated, Anglo American has agreed to lend to the company amounts totalling £2,500,000. In due course, further issues of shares will be made to produce funds which, together with the proceeds of the initial issue and loans, will be sufficient to bring the mine to production.

Shaft sinking was started in September, 1953. Twin concrete-lined circular shafts, 26 ft. and 22 ft. in diameter respectively and 350 ft. apart, known as the Pioneer Main and Pioneer Ventilation shafts, had reached respectively depths of 218 ft. and 63 ft. by March 31, 1954. The mine and milling plant are being designed for an initial monthly output of 100,000 tons.

ELLATON GOLD MINING CO. LTD.

After the death of Mr. Charles Scott in 1932, his son continued to work the Strathmore property until all reef to the west of the outcrop was cut off by faulting and the extension could not be found either by development or by boreholes.

In 1937, the right to prospect on Strathmore was given to the Anglo Transvaal Consolidated Investment Co. Ltd., who owned the adjoining ground. Four boreholes drilled by Anglovaal yielded payable intersections of an uncorrelated reef, found later to be the Vaal Reef, but in interpreting the results it was felt that the area underlain by the reef was too small to warrant further work. During 1945, Anglovaal, which had agreed to underwrite a share issue of Eastern Rand Extensions, suggested that the latter company should acquire the mineral rights of Strathmore farm and combine it with other properties held under option by Anglovaal and others; namely, Klerksdorp Townlands, a portion of Palmietfontein 29, various portions of Nooitgedacht 53, and the property of the New Klerksdorp Gold Estates. Eastern Rand Extensions accordingly purchased the mineral rights of Strathmore Farm from Mr. J. Scott and gave an option and prospecting contract over these mineral rights to Strathmore Gold Mining Co., a new company formed under the auspices of the Anglo Transvaal Group. Anglovaal surrendered its existing option over Strathmore Farm in favour of the Strathmore Gold Mining Co.

The issued capital of the Strathmore Gold Mining Company was £100,000, divided into 400,000 shares of 5s. each, which were subscribed for in varying proportions by Eastern Rand Extensions, Middle Witwatersrand, Anglovaal, and Western Reefs. The company embarked upon a drilling programme in the area held by it, and as the programme progressed it became necessary to borrow further funds from its shareholders. The net amount borrowed was £19,648.

When these loans were exhausted, the company allowed its options to lapse and the mineral rights and options held reverted to the various shareholders who had given the options.

During 1951, Strathmore Gold Mining Co. acquired fresh options over Strathmore Farm and portions of Nooitgedacht 53 from Eastern Rand Extensions and Anglovaal. Strathmore Exploration was a party to this agreement and transferred to Eastern Rand Extensions and Anglovaal their agreed proportions of shares in Strathmore Gold Mining Co. at cost, i.e. £1 each. It was a condition of the agreement that, on cession of the mineral rights of Strathmore and Nooitgedacht into the name of Strathmore Gold Mining Co. Ltd., the loan accounts, amounting to £19,648, should be waived by Strathmore Exploration.

On September 15, 1951, the name of the Strathmore Gold Mining Co. Ltd. was changed to Ellaton Gold Mining Co. Ltd. and drilling operations on the farm Strathmore were commenced at the expense of Strathmore Exploration and Eastern Rand Extensions. The amounts expended on behalf of the Ellaton Gold Mining Co. have been refunded.

The results of drilling indicated the presence of payable Vaal Reef in sufficient quantities to warrant the erection of a plant for its extraction at a milling rate of 30,000 tons per month.

Ellaton is the most recent mine of the group to be brought into production, which started in January, 1954, after a short trial milling period. The mill is now operating at its final designed capacity of 30,000 tons per month. The capital to bring the mine into production was provided almost entirely by means of loans, the company having borrowed an amount of £2,500,000 bearing interest at the rate of 5½ per cent per annum from Anglo American. Repayment of the loan will be made by allocating two-thirds of the profits available for distribution in each financial year, the total amount being repayable not later than June 30, 1960.

The mine is exploiting the Vaal Reef, which lies at a comparatively shallow depth west of the Buffelsdoorn Fault on the farm Strathmore 15. The underground exploration was carried out initially from a small vertical prospecting shaft. These workings were later connected by means of a cross-cut on the 7th Level to the main hoisting shaft, which reached its final depth of 1,400 ft. by 1953.

By December 31, 1953, the total footage developed on Vaal Reef amounted to 5,631 ft. Of 5,370 ft. sampled, 92.8 per cent proved payable at an average value of 500 in. dwt.

The pumping of uranium-bearing slimes from Ellaton for treatment at Stilfontein will commence towards the middle of 1954, on completion of the extensions to the plant at Stilfontein.

BABROSCO MINES (PTY.) LTD.

Strathmore Consolidated Investments owns 50 per cent of the share capital of Babrosco, which is milling at the rate of approximately 14,000 tons per month. This mine is exploiting reefs of the Government Reef series in an area of 350 claims on the farm Rietkuil, where some of the first claims were pegged in the Klerksdorp district towards the close of the last century.

Babrosco has recently been admitted to the uranium production scheme. It will pump its uranium-bearing slimes through a pipeline 22 miles long for treatment in the Stilfontein plant.

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New Union Goldfields Limited

THE year to June 30 last, covered the second complete year of this company's operations since the Judicial Management Order against it was lifted in June, 1951. The director's report and accounts covering this period were issued to shareholders last November, together with a very comprehensive statement by the chairman on the company's position. The information which follows is based substantially on this statement.

The profit for the year under review, before providing for taxation, was £63,800, as compared with £62,300 for the previous year. Taxation absorbed £7,800, as against £5,000 in 1952. Expenditure written off in respect of propositions investigated amounted to £12,200, and in addition an exploratory reserve of £50,000 has been set up to provide against future expenditure under this heading.

Amounts written off share investments totalled £1,140,900 against which there were transfers from various provisions and reserves amounting to £1,169,000. In addition, £10,000 was written off certain mining interests, and this too was covered by the transfer of an equal amount from a provision previously set aside for this purpose. After placing £10,000 to note redemption reserve, the balance of profit unappropriated at the close of the year was increased to £54,900, compared with £30,800 brought in at July 1, 1952.

During the year to June 30 last, New Union Goldfields increased its shareholdings in a number of the associated companies in the group, and at the same time the Board continued its policy of refraining from disposing of the company's more promising investments, even at prices which would have shown an attractive margin of profit.

THE GROUP'S GOLD INTERESTS—

The group's most important individual investment in the Orange Free State field is in Harmony Gold Mining Company, Ltd., New Union was one of the joint underwriters of the Harmony Company's recent capital issue of some £4,306,000. The Harmony Mine has been accepted as a uranium producer, and is expected to commence gold production early in the latter half of 1954, and uranium production shortly thereafter.

Another of the group's major shareholdings is in New Free State Gold Estates, Ltd. That company owns the mineral rights of approximately 279 morgen of the Farm La Riviera No. 289, immediately north of the Harmony Mine and there are reasonable prospects that, in due course, a substantial portion of these mineral rights will be included in the "Saaiplaas" lease area. The company has recently made a fresh issue of capital, which has enabled it to take up the "rights" on its holding of 300,000 Harmony shares, leaving over a balance of working capital sufficient for its immediate requirements. This issue was underwritten by New Union.

New Union Goldfield's interests in producing gold mines in the Transvaal are held mainly through affiliated financial companies.

—AND DIAMOND INTERESTS

The company's diamond interests are held through the subsidiary company, Selected Mining Holdings, Ltd., which owns the entire issued capital of Westar Diamond Mining Company, Ltd., and 43½ per cent of the issued capital of Star Diamonds (Proprietary), Ltd. Arrangements have recently been made—but are not yet finalized—to acquire the outside shareholdings in the latter company. Unfortunately, over the past year there has been a substantial fall in the price of diamonds, as the result of which the Star Mine has been operating at a loss in recent months. However, it is intended to combine the Star and Westar properties into a single mine, which should enable production to be increased to a level sufficient to make the joint mine to be operated on a profit-earning basis, notwithstanding the fall in diamond prices referred to above. Prospecting operations have been carried out on the Westar property with encouraging results.

S.A. Grain and Seeds Distributors, Ltd., concluded the sale of the Zak River Estates farming project in the Cape Province for the satisfactory figure of £275,000, after paying all expenses, thereby realizing a profit of approximately £43,500.

New Vaal Farms, Ltd., made an issue of £114,429 of 5½ per cent Convertible Debenture stock during the year to secure the funds initially required for an irrigation scheme on its farming land along the Vaal River. New Union underwrote £84,429 of this issue and £30,000 was subscribed firm by New Union General Industries, Ltd., an associated company.

RESERVES, PROVISIONS AND LIQUID POSITION

The recent settlement of Mr. J. Milne's claim against New Union marks a further step forward in the process of freeing the company from all the claims against it, and the rather formidable list of these claims and actions which were outstanding against the company in June, 1951, when the Judicial Management Order was lifted, has now been reduced to three items in respect of which a contingency reserve of £290,000 is held against any liability which the company may eventually be called upon to meet.

The company's reserves and provisions have been drawn upon during the past financial year to write down the shareholdings to a more realistic level and this has been done without impinging upon the profits for the financial year ended June 30, 1953. Revenue reserves and surplus at that date totalled £464,890, in addition to the provision of £30,000 for doubtful debts.

Current assets at the close of the financial year exceeded current liabilities by £105,344, of which excess £89,869 was represented by cash at bank and on short call.

Calls for additional cash for the Orange Free State investments, coupled with requirements for consolidating the group's holding position, have imposed some strain on cash resources, but the overall position can be considered satisfactory.

REORGANIZATION WITHIN THE GROUP

The Board has been investigating ways and means of consolidating the interests of certain of the group's companies. From the viewpoints of administrative economy and of investment strength, there are obvious advantages to be derived from such consolidations, and as a first step in the process, an agreement has been entered into between New Witwatersrand Gold Exploration Company, Ltd., and West Rand Development and Exploration, Ltd., which, subject to ratification by the shareholders of both companies, provides for the consolidation of their respective interests.

A second step in the process will be the transfer of most of the group's real estate interests into New Union Land and Estates, Ltd., and as a third step, it is the intention to concentrate as many as possible of the group's industrial shareholdings in New Union General Industries, Ltd.

New Union has taken over the administrative control of Anglo-Rand Mining and Finance Corporation, Ltd., and its associated companies. To a considerable extent the future of the Anglo-Rand Company is dependent upon the two tin mines operated by Union Tin Mines, Ltd., and Vellefontein Tin Mining Company, Ltd. Apart from the setback occasioned by the fall in the world price of tin, considerable difficulty has been experienced in the past at the Union Tin Mine in extracting the cassiterite which occurs in a very fine form. Progress has been made towards solving this extraction difficulty, but it is too early to say whether the problem has been successfully overcome.

At the Vellefontein Tin Mine the cassiterite occurs in a much coarser form and it is hoped that no such difficulties of extraction will be encountered. Progress in bringing the mine to production on a small scale is proceeding, and it is anticipated that the mine will commence production before the end of this calendar year. It must, however, be emphasized that the prospects of these two tin mines are closely linked with future fluctuations in the world price of tin.

In addition to the tin interests described above, the Anglo-Rand Company enjoys a non-contributory participation with the Union Corporation, Ltd., in respect of certain areas in the Bethal and Delmas districts which are held under option and prospecting contracts by various subsidiary companies of the Union Corporation. Prospecting operations are being conducted and some encouraging gold values have been obtained in the Kimberley Reef.

No conclusions can yet be drawn as to the economic possibilities of the area, and thus of the potential value of this participation.

THE OUTLOOK

Although there has been no marked improvement in New Union's financial or profit position during 1953, a good deal of steady progress has been made towards rationalizing and strengthening the overall position of the group of companies of which New Union is the hub. No substantial improvement in the revenue position can be anticipated until such time as some of the major Orange Free State investments reach the dividend-paying stage, but the general outlook is not discouraging and as the chairman, Lt.-Col. R. L. Broad, pointed out in his statement to shareholders last November, "although patience is still called for, a steady and progressive improvement in the position can be envisaged with reasonable confidence over the course of the next two to three years."

South Africa

Anglo-French Exploration Co., Ltd.

TO describe the progress of Anglo-French Exploration over the past two decades in terms other than those connoting steadiness, solidity, and consistency would be inexplicable. Dividend distributions have been made each year during this period; 10 per cent being paid in each of the six years 1933-1938; 5 per cent being paid during the next six years, 1939-1944; and 7½ per cent being paid in each of the last ten years, 1945-1954. Throughout this period its ordinary issued capital has been raised from £500,000 to £800,000 in stock units of £1 each at which figure it now stands.

Unspectacular though the foregoing facts and figures may be, they should not be construed as indicating that the company has merely made once-for-all-time-investments and then sat back in the hope that the return on capital invested would enable distributions to be maintained. Indeed, not so many years ago Anglo-French relied more heavily for its profits on share dealing activities than on dividend income. In 1947, for example, dividend income totalled £43,359 while share dealing activities brought in £63,815 giving a total profit from these two sources in that year of £107,174. It is difficult to know when the company decided to choose as between dividend income and share dealing profits as its major source of earnings but if 1947 can be taken as a guide, the past record of the company shows that dividend income in the six ensuing years 1948-1953 increased each year to the record level of £82,322 in the year 1953 while its income from share dealings declined each year to a record low of £16,193 in the year 1953. All this time, total profit from these two sources varied less than £15,000.

Since 1951 the company has given a broad classification of its investments expressed as a percentage of their valuation, and this is reproduced below.

Year	*Gold** %	*Oil* %	*Copper†* %	*Tin* %	*Coal* %	*Other* %
1953	63.0	13.7	8.0	8.0	7.0	0.3
1952	61.7	12.0	9.7	9.8	6.5	0.3
1951	59.0	12.3	10.4	10.3	7.8	0.2

* Including holding companies which have substantial interests in gold mining companies. † Refers to holdings in copper, lead and zinc.

Gold mining occupies the largest place in the portfolio and the major proportion is in the mines situated along the West Wits Line, namely, West Driefontein, Libanon, Venterspost—to mention the three regular dividend payers—and Doornfontein which came into production in November last.

The company has taken a keen interest in the Orange Free State Goldfield and its portfolio now includes Free State Geduld, Loraine Gold, New Consolidated Free State Exploration, Orange Free State Investment Trust, Welkom, Western Holdings, Wit Extensions, and Harmony, which was brought into the portfolio during 1952 and further shares acquired during the year 1953. Other holdings in gold mining companies as at December 31, 1953, were Consolidated Goldfields of South Africa, Durban Deep, Vlakfontein, West Witwatersrand Areas, and Harrietville (Tronoh), the Australian gold dredging concern.

Oil investments, ranking next in value to its gold shares, relate to its holdings in Apex (Trinidad) Oilfields and in Ultramar. Base metal interests encompass Nchanga Consolidated Copper Mines, Messina (Transvaal) Development Co., while indirectly, its interests in the remaining Northern Rhodesian Copperbelt producers is gained through its holding of Rhodesian Selection Trust and Rhodesian Anglo American. The company has also invested in Mount Isa, the important Australian copper-lead-zinc-silver and, perhaps, uranium producer.

Its well chosen holdings in Malayan tin companies include Ayer Hitam, Sungei Besi, Malayan Tin Dredging, the holding in which was increased during 1953, Pengkalen, Petaling Tin and two producers outside Malaya, Rooiberg Minerals and Anglo-Burma Tin. The South African coal industry is represented in its portfolio by its relatively large holding in Apex Mines.

At December 31, 1953, the book cost of the company's investments stood in the balance sheet at £990,859 (£988,072) of which £949,868 (£944,127) represented quoted securities at or below cost having a market valuation of £1,174,112 (£1,148,028) and the remainder, £40,991 (£43,945), its unquoted investments.

The profit and loss account for the year ended December 31, 1953, showed total income at £98,515 (£95,685) and a net profit, after tax charges of £39,841 (£38,368), of £33,320 (£31,938). The dividend payment of 7½ per cent required a net £33,000 and the forward balance was £29,868 compared with £29,548 brought in.

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During the year ended June 30, 1953, both mining revenue and investment income were adversely affected by reduced proceeds from the sales of base metals. Zinc prices dropped to such a low level that it became impossible to produce this metal at a profit and the company was therefore compelled to suspend extraction and treatment of zinc ores. The average price received for lead during the year under review was some £60 per ton less than in the previous twelve months. Tin fell steeply in April, its average price during the last quarter of the Company's financial year being some £200 less than that for the preceding nine months and wolfram prices declined gradually but substantially for the last nine months of the period.

The lead/vanadium section of the mine at Abenab West continued to operate at full capacity but the serious falls in the prices of lead and zinc were not fully compensated by the anticipated increase in sales of fused vanadic acid. These would have been greater during the year under review had it not been for the general decline in the demand for vanadium.

An analysis of the ore sales account for the last three years shows:—

Year to June 30	*Lead* (conc.)*	*Vanadium (conc.)*	*Vanadic† Acid*	*Zinc (conc.)*	*Wolfram (conc.)*	*Tin (conc.)*
	£	£	£	£	£	£
1953	216,761	138,640	882,539	—	32,339	41,598
1952	637,601	230,038	354,513	141,868	40,639	15,428
1951	436,586	98,226	273,176	44,091	7,232	31,675

* Lead ex lead/vanadium concentrates.
† Fused vanadic acid from further treatment of the concentrates.

At the annual meeting in December, 1952, the chairman warned shareholders that a considerable reduction must be anticipated in the profits for 1952-53. This forecast was unhappily borne out by a drastic reduction in profits resulting from a combination of falling prices and rising costs.

An analysis of the cost of producing the principal products shows:—

Year to June 30	*Mining Costs*	*Refining Costs*	*Shipments* Cost*	*Prospecting*	*Admin.† Costs*	*Total Costs*
	£	£	£	£	£	£
1953	400,431	663,557	89,596	31,001	56,406	1,240,991
1952	298,873	259,956	142,592	31,230	47,374	780,025
1951	221,242	124,553	40,256	13,488	29,192	428,731

* Refers to ore shipment and charges by rail to Walvis Bay.
† Including headquarters and administrative expenses and local taxes.

The Company's income from investments has been mainly derived from its holding in Tsumeb Corporation, Ltd.

The profit on the year's working, before allowing for taxation, was £67,224, compared with £478,461 for 1951-52. The balance carried forward from the previous year was £42,717 and surplus taxation provisions for the previous years amounting to £11,343 were also in hand. After allowing £67,285 for taxation, the amount available for distribution was £53,999. Dividends totalling 2s. per 13s. 4d. share (compared with 8s. in 1951-52) absorbed £29,249, leaving the sum of £24,750 to be carried forward.

At the annual general meeting in January, 1954, the chairman sounded a note of cautious optimism regarding the current financial year, and stated that the prices of lead and zinc remain at a low level compared with those ruling during the peak period but the production of lead-vanadium concentrates has increased substantially, thus reducing the cost per ton of concentrates to a considerably lower figure. Sales of vanadium show no signs of immediate improvement but the progress of the Company's operations on the tin and wolfram ore bodies in the Brandberg area has been encouraging.

WOLF

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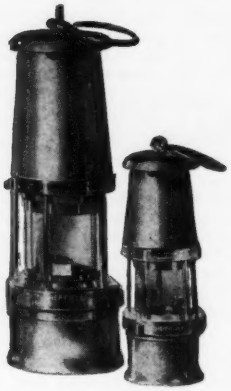

The WOLF COMPANY of SHEFFIELD have been making mine lamps for 70 years and Wolf lamps of one type or another are used throughout the world.

WOLF make Acetylene Hand, Cap and Railway Lamps and Flares.

WOLF make eight different Flame Safety Lamps for methane detection, five of which have interchangeable spare parts and use the same fuel and equipment.

WOLF make compressed air operated Electric Safety Lamps and a Sealed Beam Lamp for use above and below ground.

WOLF make a wide range of Electric Lamps with alkaline accumulators: Hand, Cap and Inspection Lamps for mines; head and rear lights with spring carriers for locomotives and four approved for use on ships.

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SAXON ROAD WORKS, SHEFFIELD, 8
ENGLAND

TELEPHONE 51051/2 **TELEGRAMS "WOLFITE"**

Henderson's Transvaal Estates Ltd.

HENDERSON'S TRANSVAAL ESTATES LTD. was formed in December, 1912, as a reorganization of a company of the same name registered in Rhodesia in 1908, which was itself a reconstruction of the original company registered in London in 1894. Throughout its long and successful career the company has sought opportunities for participating constructively in the mining and industrial expansion of South Africa. The greater part of its revenue is derived from its subsidiary companies—Henderson Consolidated Corporation, Mineral Holdings, Tweefontein Colliery Ltd., and Tweefontein United Collieries—but a substantial income is also received from participation and share interests in many other undertakings.

TRADING RESULTS

The reports and accounts of the parent company for the year to March 31, 1953, reflect the very strong financial position resulting from the policy of conserving and strengthening liquid resources, which the Henderson's group has always pursued. The market value of quoted investments, together with the directors' valuation of unquoted securities, amounts to £668,416 against a book value of £679,399. The unquoted securities are mainly represented by a large holding in White's South African Portland Cement Co. Ltd. Provision for depreciation of investments amounting to £100,000 has been made.

The working profit amounted to £86,158 compared with £99,274 in the previous year, the decrease being accounted for by a reduction of approximately £9,000 in dividends received from subsidiaries and a decrease of some £5,000 in profits on share-dealing transactions. This decline in earnings was more than offset by a reduction in taxation of £15,142 to £39,454 with the result that the net profit amounted to £46,704 against £44,678 in the preceding year. For the seventh successive year a dividend of 15 per cent was declared, which required a net £46,486, leaving the carry forward at £57,246 compared with £57,028 brought in. No allocation was made to general reserve which stands at £350,000.

Year to March 31	*Total Income*	*Total Expenses*	*Taxation*	*Net Profit**	*Dividend*	*Carry Forward*
	£	£	£	£	£	£
1953	267,782	44,852	103,706	81,399	46,486	171,392
1952	219,998	47,403	96,588	45,013	44,373	173,830
1951	266,093	51,424	88,182	93,509	44,373	173,190

* After providing for minority interests.

CONSOLIDATED PROFIT AND LOSS ACCOUNT

The consolidated profit and loss account showed gross revenue at £267,782 and net earnings, after providing £12,825 (£10,994) for minority interests, at £81,399—an increase of £36,386 over that achieved in the preceding year.

The consolidated balance sheet showed that current assets amounted to £567,903, which included cash resources of £158,085 and deposits and loans at call of £183,000. Current liabilities were recorded at £172,536 and thus net current assets stood at £395,367 which compares with an issued capital in 4s. stock units of £563,697.

COLLIERY INTERESTS

The company's South African coal interests are held through its subsidiary, Tweefontein United Collieries, whose operations for the year ended December 31, 1952, resulted in a profit on coal amounting to £168,000 compared with £129,000 during the previous year. This company's operations have benefited from improved transport facilities and also from an increase in the inland price of coal. On the other hand, much of the increased revenue has been absorbed by higher rates of taxation which came into force on July 1, 1952. Coal production during 1953 amounted to 1,279,529 tons compared with 1,317,125 tons in 1952. Output continues to be governed by the availability of truck supplies.

At the last annual general meeting of the parent company, held in July, 1953, Sir Joseph Ball, the chairman and managing director, stated that plans were under consideration for the exploration and establishment of further reserves of coal from the intact areas contiguous to the existing workings of Waterpan and Tweefontein No. 2. Boreholes drilled west of the Tweefontein plant have now proved that No. 2 seam underlies this area, and that its thickness and calorific value are satisfactory. In addition, the drilling results west of the Waterpan workings have established the presence of No. 2 seam in this area, and two boreholes have also encountered the No. 1 seam, the quality of which is up to standard value over a mineable width, although further drilling is necessary before arriving at an estimate of the tonnage of coal of economic value available which may extend the life of the Waterpan shaft.

Shaft sinking was started on West Tweefontein in November, 1952, and plans have been made for the coal produced from the new section to be handled by the existing screening and washing plant. Dividends on the ordinary shares for the year ended December 31, 1952, were reduced to 10 per cent as compared with 15 per cent during the previous year, the reduction being considered desirable for the purpose of conserving the company's cash resources in order to provide finance for the required development.

The opening of these new reserves will place Tweefontein in a favourable position to benefit from the strong inland demand for coal which may be anticipated from the development of the O.F.S. gold field and of secondary industries, and from the expanding requirements of the Electricity Supply Commission.

INDUSTRIAL INTERESTS

Among the more valuable assets of Henderson's Transvaal are its substantial holdings in White's S.A. Portland Cement. From a small beginning this undertaking has developed into one of the leading companies in the South African cement industry. A large and modern factory has been established at Lichtenburg which produces high quality cement at low cost. Part of the company's expansion programme has been directed towards obtaining additional raw material and a property, containing a substantial quantity of reasonably high-grade limestone, was acquired in 1951.

Both the new Lichtenburg factory and the old White's factory in the Orange Free State have been working to capacity for several years, the latter factory being well placed to supply the growing demands of the new gold field. Having regard to the large volume of construction work in the urban areas of South Africa and the rapid tempo of mining and manufacturing development, it is evident that this progressive and efficient undertaking is assured of ready markets for its products for a long time to come.

MINERAL HOLDINGS

Through Mineral Holdings, Ltd., the parent company owns freehold lands totalling 14,798 morgen, mineral rights over 319,436 morgen, and concessions in Swaziland over areas totalling 355,681 morgen. Investigations of some of these areas are in progress.

VRYHEID COPPER

The company's Vryheid property, owned by Mineral Holdings Ltd., and adjoining the property of Messina (Transvaal) Development, has been accorded very careful consideration by the Board. Geological and geophysical work had indicated the possibility of finding workable copper deposits on Vryheid on what is known as the Dowe-Tokwe fault. The company's engineers were of the opinion, however, that in order to prove or disprove the existence of a payable mine, it would be necessary to carry out a programme of at least 350 ft. of shaft sinking, plus a further 3,000 ft. of driving and cross-cutting, at a cost estimated in June, 1952, of some £53,000, this estimate being made on the assumption that a supply of electricity could be obtained from Messina at a reasonable figure.

Shortly afterwards, it was reported that the Messina Company had started exploratory drilling on the Dowe-Tokwe fault immediately adjacent to and west of Vryheid. The engineers therefore recommended that, in the circumstances, the company should await the result of Messina's investigations before starting on its own programme of shaft-sinking, driving and cross-cutting. This recommendation was accepted by the Board.

Although the price of copper has fallen moderately, the long-term outlook for the metal is reasonably assured. It is possible that should the results of Messina's current investigations be favourable, exploration and development at Vryheid may be actively resumed.

East Rand Consolidated Ltd.

ROUGHLY two-thirds of the book value of the assets held by East Rand Consolidated at the end of 1952 related to investments in quoted or unquoted shares and in holdings in subsidiary companies, while a sizeable proportion of the remaining assets consisted of mineral rights, prospecting contracts or participation in oil ventures.

The profit and loss account for 1952 once again showed that a large part of the company's revenue came by way of dividends or interest. The investment portfolio contain 22 quoted securities, largely concerned with mining enterprises in West Africa, Rhodesia, the Orange Free State and the Transvaal, but by far the most important holdings are those of four companies based on the Far East Rand. These are Spaarwater, which is under the technical management of New Consolidated Gold Fields, and Witwatersrand Nigel, West Spaarwater and West Vlakfontein, which are under the technical management of East Rand Consolidated through its subsidiary, African Exploration Company.

The policy pursued by East Rand Consolidated over the course of the past few years is beginning to justify itself. This policy was to change the contents of its portfolio into either dividend paying investments or selected developing mines. In 1952, the revenue producers yielded over 50 per cent more income than in the previous year, that is to say, an extra £7,286. But against this, mining operations caused a loss of £3,689. During the year, the Board changed its policy towards investments; now any depreciation that may have taken place in the book value of any particular investment at the end of the financial year is written off, but no account is taken of any appreciation that may have occurred over original costs on other investments. To implement this policy, the Board allocated £65,950 and this, together with the need to write £16,268 off abandoned mineral rights, changed the £12,443 profit into a deficit of £69,775.

The abandonment of mineral rights has left East Rand Consolidated with two main property interests in the Orange Free State. To the south-west of the area held by Loraine Gold lie two farms, Bloemfontein 115 and Genog 1330, where 10,000,000 tons of coal have been located. East Rand Consolidated holds option and prospecting contracts over 900 morgen of these two farms. The other area, lying directly south of Merriespruit at the extreme south of the Orange Free State goldfield, is part of the farm Welgelegen No. 382, where the company has purchased the mineral rights, totalling 276 gold mining claims. East Rand Consolidated continues to hold 3,783 gold mining claims on farms Maraisdrift and Klipportje, lying between the Witwatersrand Nigel and Spaarwater mines in the Far East Rand.

WITWATERSRAND NIGEL LTD.

At the southern extremity of the South-East Rand lies a large area, comprising 12,569 claims, in which Witwatersrand Nigel is interested.

One of the shafts serving the Houtpoort section is now nearing the end of its effective life as it has been found that it will not be an economic proposition much longer to mine the lower levels of the Houtpoort shoot from the No. 1 shaft. It has been decided to sink another shaft, to be called No. 3 shaft, at a cost of £300,000. This shaft will be approximately 14,000 ft. from the shaft it will replace and it is hoped to cut the reef at a depth of about 3,000 ft.

Year to June 30	*Milled Tons (000)*	*Per ton milled Grade (dwt.)*	*Cost* s. d.*	*Working Profit £*	*Capital Expend. £*	*Ore Reserves Tons (000)*	*Grade (dwt.)*
1953	202.4	4.514	47 8	100,041	33,495	729	4.4
1952	136.0	4.807	58 7	22,258	120,665	690	4.4
1951	119.9	5.098	60 10	31,417	28,002	661	4.5

* Including development

Meanwhile a mill with a nominal throughput of 7,000 tons per month has been erected to treat ore from the Poortje section. In the year to June 30, 1953, 202,400 tons of ore were treated, or 66,400 tons more than in 1951-52. As the ore in Poortje section is of a lower grade than in Houtpoort, the average grade sent to the mill dropped but the fall of 0.293 dwt. in the grade was more than made good by a contraction in working costs of 10s. 11d. per ton.

As a result, working profits increased materially from £22,258 to £100,041. By virtue of past losses, the company is not liable to South African income tax and the net profit for the year was £103,880. This compared with £25,574 for the previous year. Monthly profits for the first nine months of the currrent financial year total £76,941.

Development during the year ended June 30, 1953, advanced 16,422 ft., of which 11,180 ft. were sampled, having an average payability of 38.1 per cent and a value of 237 in. dwt. Ore reserves rose by 39,000 tons at the end of that year to 729,000 tons, the value and stoping width remaining unchanged at 4.4 dwt. and 37 in. respectively. During the nine months since the close of the year, 11,837 ft. have been advanced, of which 8,390 ft. were sampled, having an average payability of 34.7 per cent and a value of 14.5 dwt. over a width of 18.3 in.

On November 30, 1953, the company declared a maiden dividend of 5 per cent.

SPAARWATER GOLD MINING CO. LTD.

The reef in this area of the S.E. Rand is not so rich as it is in the neighbouring Sub Nigel property but the yield of 4.537 dwt. per ton in 1953 compares very favourably with the average of 3.887 dwt. for the whole of the Transvaal in the same year. The benefits from treating ore of this grade is restricted by the small size of the plant, which at 10,000 tons per month official capacity is one of the smallest on the Rand.

Year to Dec. 31	*Milled (tons)*	*Per Ton Milled Grade (dwt.)*	*Yield (oz.)*	*Cost* s. d.*	*Ore Tons (000)*	*Reserves Grade (dwt.)*	*in. dwt.*
1953	127,500	4.537	28,921	47 6	150,000	6.2	230
1952	127,000	4.495	28,546	41 2	126,000	5.5	204
1951	124,800	4.523	28,226	40 5	175,000	5.6	204

* Including development expenditure

In recent years, the comparatively small surpluses have been swallowed up by development costs; in 1953, for example, development costs of £89,478 turned the surplus of £60,026 into a working loss of £29,452. In that year various items of non-mining revenue exceeded non-mining expenditure by the useful margin of £7,016, and this sum was used to reduce the year's loss to £22,436. On this occasion, the development results were a little more favourable. Although the footage developed of 14,037 was roughly the same as the 14,133 ft. of the previous year, the footage sampled rose from 12,055 to 13,320, and payability improved from 33.3 per cent to 44.2 per cent. For the first three months of 1954, of 1,540 ft. sampled in the western section of the mine, 51.3 per cent proved payable.

It is interesting to note that the loss, after development charges, for the first three months of 1954 totalled only £1,487, and in fact small profits were made during March and April.

Year to Dec. 31	*Mining Revenue £*	*Working Profits £*	*Development Costs £*	*Net* Loss £*	*Taxation £*	*Carry Forward £*
1953	362,679	60,026	89,478	22,436	7	173,660
1952	364,963	103,442	123,220	20,166	8	151,217
1951	368,341	116,181	124,948	12,395	7	131,043

* After allowing for sundry revenue and sundry expenditure

Part of the ore reserves, that is to say, 25,600 tons of an average value of 8.2 dwt. per ton, will not be available for mining until further ventilation has been provided. Another proviso has to be made. Development has been mainly confined to the known pay zones and hence the results obtained cannot be considered representative of the whole mine. In order to investigate whether the payable zone previously encountered in the area of the 37 West Haulage continued, no advance was made and during the year work on 34 West 10 Haulage stopped owing to the steepening dip of the reef, but a heading was started to effect a connection, completed towards the end of November, 1953, between the two haulages.

Subsidiary development in the western area of the mine yielded good results, the value of 323 in. dwt. being encouraging and at the end of the year, work was being directed towards preparing this area for stoping.

WEST VLAKFONTEIN GOLD MINING CO. LTD.

When West Vlakfontein was first floated in 1937 it was hoped that the reef would extend from one of the surrounding properties. Various attempts have been made to discover whether the reef did, in fact, continue, but these efforts were disappointing and in November, 1953, the directors recommended the disposal of the machinery, plant and other movable assets of the mine to the best advantage.

Rhodesian Corporation Ltd.

THAT Rhodesian Corporation felt justified in drawing on its forward balance during the year ended September 30, 1953, to enable its total distribution for the year to be maintained at 7½ per cent, was indicative of the Corporation's confidence in its future earning capacity.

The reason for the Corporation's confidence is not far to seek. Two of its major interests, namely, Falcon Mines and Rhodesian Brick and Potteries, have now firmly established themselves on a profit earning basis and should soon be contributing to the Corporation's investment income. Indeed, as will be seen from the article below on Falcon Mines, this company's entry into the list of dividend payers is only a matter of time, while the maiden distribution of Rhodesian Brick and Potteries cannot be far away. This company has two works; one in Bulawayo, and a new works in Salisbury which went over from a construction to a production basis on March 1, 1953. During the year ended September 30, 1953, the net profit of Rhodesian Brick and Potteries, after all charges, amounted to £23,657 which was transferred to reserve, making a total revenue reserve of £56,753. Rhodesian Corporation was one of the original sponsors of the company and now that it is on a paying basis the Corporation's loan, amounting to £102,000, is in the course of being repaid during the current year and will make available, if the Corporation exercises its rights in full to take up 28,050 shares of 5s. each after taking up an additional share interest in the company at 5s. 6d., the sum of £73,950 for expansion of its investment activities.

In many respects, the feature of the report and accounts concern the excellent progress made during the year under review by the Fred and Redwing Mines, the only mining venture now directly worked by the Corporation. The Fred Mine, generally speaking, is worked out and only clean-up operations are being carried out. But the Redwing Mine, which had previously been fully developed down to level 5, has been operated by the Corporation as a section of the Fred Mine since October, 1951, and operations meanwhile have been concentrated on sinking the main shaft to level 8. This was achieved during the year ended September 30, 1952, during which period the mill treated less than 1,000 tons of ore. Yet during the year under review the tonnage milled expanded to 37,260 tons averaging 3.89 dwt. per ton milled yielding 7,247 f.oz. and a working profit of £3,313.

Although the Corporation is primarily a mining finance house, in addition to its investment and mining activities, it has substantial interests in agriculture and real estate in Southern Rhodesia. During the year, the Corporation sold 1,293 acres reducing its total holding to 42,127 acres together with the developed township of Jameson Park covering 642 acres. From the sale of its properties a surplus of £2,576 was brought into the profit and loss account, the bulk of the proceeds being ploughed back into improving its other holdings, and this is reflected in the balance sheet which shows that the value of the Corporation's plant, machinery, implements and vehicles, etc., advanced from £44,898 to £71,009 and the value of its farms and estates, including buildings and improvements, from £51,493 to £81,459.

In fact, farming operations went well last year; the net revenue from farms and estates during the year ended September 30 last was £18,610 (£22,585), or next in value to the Corporation's investment income which again showed an improvement, this time at £28,063 compared with £25,030 in the preceding year. These were the principal revenue items comprising the total income of £62,692 against £102,816 in the preceding year.

Depreciation was slightly heavier, £13,868 against £11,299, and after providing for all expenses, including taxation liabilities of £1,592 (£3,328), the net profit amounted to £25,268 compared with £64,347 in the preceding year. The dividend was repeated at 7½ per cent which required a net £39,722 to pay which the Corporation drew upon its forward balance for the sum of £14,454 leaving £29,102 to be carried forward against £43,556 brought in.

Results for the current year should show an improvement over those attained during the year under review. The Fred and Redwing Mines earned a working profit of £3,279 during the first four months of the current year; Falcon Mines will almost certainly pay a dividend; and farming operations should bring in at least as much as during the year under review. Moreover, the repayment of the loan from Rhodesian Brick and Potteries will increase the scope of the Corporation's investment activities and may result in additional dividend income being received before the end of the current year.

Falcon Mines Ltd.

AT the end of Falcon Mines' last complete financial year, namely, September 30, 1953, the company's general reserve account stood at £350,000 of which £320,000 had been allocated out of earnings over the last five years. This relatively large transference of capital was necessary to finance the capital expenditure programme involved in bringing the Dalny Mine into production in June, 1952 with a reduction plant having a nominal capacity of 12,000 tons per month. Its achievement was made possible by the regular contributions to revenue from the company's two established producers, Sunace and Bay Horse; to a much lesser extent by receipts from Falcon Mines which is worked on tribute; by a small share issue in 1950 which raised the issued capital from £259,373 to its present total of £453,903 divided into shares of 5s. each, and finally by shareholders who went dividendless during this period.

Thus the results achieved during the year to September 30, 1953, provide a rough guide as to the earning capacity of the Dalny Mine. Yet the operative word in the preceding sentence is "rough" because the company began crushing without a roasting unit so that gold recovery per ton milled and profits per ounce produced were much lower than can be expected when the roasting unit is in operation. Pending the arrival of the roasting unit, the company sent the maximum permitted amount of its unroasted concentrates to the Government roaster at Que Que and stockpiled the remainder. Irritating though this procedure may have been at the time it was in effect, akin to forced savings as the company stockpiled no less than 5,075 tons of concentrates saving an estimated average value of 22 dwt. per ton and no account of these stockpiled concentrates have been taken into consideration in the profit and loss account for the year under review, the salient features of which are given in the following table.

Year to Sept. 30	*Mining Profit*	*Gross Revenue*	*Expenses*	*Net Profit*	*To Reserves*	*Carry Forward*
	£	£	£	£	£	£
1953	71,416	72,700	9,931	62,769	50,000	22,835
1952	70,030	75,691	8,781	66,910	120,000	10,066
1951	51,565	58,347	8,210	50,137	50,000	63,374

Comment, however apposite and provocative it may be on the above results, must necessarily be misleading as the essential fluo-solids roaster was not in operation. It follows, therefore, that interest centres around events which have occurred during the first five months of the current year ending September 30, 1954.

The chief feature of the current year's activities was the arrival of the roasting unit in December last. The foundations for its installation had been completed some months previously and trial runs of the units were commenced in April, 1954. Meanwhile, during the first six months of the current year a further 3,248 tons of flotation concentrates, having an estimated value of 19 dwt., were stockpiled bringing the total of stockpiled concentrates up to 8,323 tons having an estimated average value of 20 dwt. per ton. While the percentage gold recovery from these concentrates cannot be ascertained beforehand, the resulting profit will be very welcome indeed as the roasting unit is being largely financed by overdraft facilities and its cost of approximately £75,000 should be more or less taken care of by the revenue received from their treatment by the roasting unit. If so, this would free the company of its overdraft and enable it to resume dividend payments out of current earnings. Generally speaking, this is the policy the board hopes to effect as Mr. E. B. Papenfus, the chairman, said in his address to shareholders that the payment of a dividend was only awaiting the installation and successful operation of the fluo-solids roaster.

Year to Sept. 30	*Milled*	*Per ton milled*			*Capital Expenses*	*Ore Reserves*	
		Grade	*Yield*	*Cost**		*Grade*	
	(tons)	*(dwt.)*	*(oz.)*	*s. d.*	£	*(000 tons)*	*(dwt.)*
1953	142,000	2.47	17,535	27 2	24,150	566	4.5
1952	62,300	†2.55	7,950	29 0	139,147	536	4.0
1951	28,070	‡3.11	4,365	34 3	243,000	483	4.2

*Includes development charges.
†Including 4 months operation of main reduction plant.
‡10 months operation with pilot plant.

The outlook for the current year is again bright. The Southern Rhodesian Government may institute a scheme involving subsidies to producers; no tax charges will be payable; and earnings, in the absence of unforeseen difficulties, should be sufficient to cover a dividend payment as well as enabling the company to begin building up its depleted financial resources.

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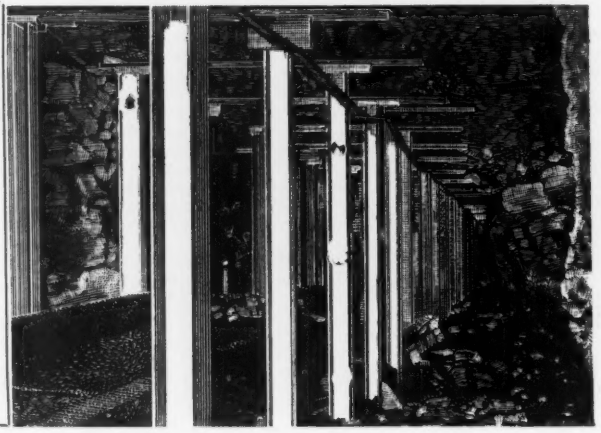
4in.	x	4in.	x	13 ,,	,, ,,
4in.	x	4in.	x	15.75	,, ,,
4½in.	x	4½in.	x	18 ,,	,, ,,
5in.	x	3in.	x	14 ,,	,, ,,
5in.	x	4½in.	x	18 ,,	,, ,,
5in.	x	4½in.	x	20 ,,	,, ,,
5in.	x	5in.	x	21 ,,	,, ,,

METRIC SIZES (Approx)

75	m/m	x 75	m/m,	15	Kgms/m.
90	,,	x 90	,,	20	,,
100	,,	x 100	,,	20	,,
100	,,	x 100	,,	25	,,
125	,,	x 75	,,	21	,,
115	,,	x 115	,,	27	,,
125	,,	x 115	,,	27	,,
125	,,	x 115	,,	30	,,
125	,,	x 125	,,	31	,,



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Wankie Colliery Co., Ltd.

THE WANKIE COLLIERY CO., LTD., owns concessions in Southern Rhodesia over an area estimated to contain some 350,000,000 tons of saleable and extractable coal. Its original property covered 400 sq. miles, but in 1950 the greater part of the concession was acquired by the Government of Southern Rhodesia for £350,000.

Situated on the main route of the Cape/Cairo railway, about 212 miles north of Bulawayo and 68 miles south of Victoria Falls, Wankie is the sole source of supply of coal and metallurgical coke within a radius of some 500 miles, thus encompassing the Northern Rhodesian Copperbelt producers who are almost wholly dependent on Wankie for their fuel supplies. Indeed, Wankie serves the needs not only of the two Rhodesias but also of the Belgian Congo, and is of critical importance to the continued development of Central Africa. Careful studies have been made of the future demands for coal in the Federated Territories and, based on information furnished by consumers, it has been indicated that the company will have to provide for an increase in output capacity from the present level of about 2,750,000 s.tons per year to 5,000,000 s.tons per year by the end of 1956.

CAPITAL EXPENDITURE PROGRAMME

In 1949, it was anticipated that a capital expenditure of at least £2,000,000 would be required to expand production in line with the rapidly increasing requirements of the area. The company's capital was accordingly doubled by the creation of 3,400,000 new 10s. shares, of which 3,293,750 were issued at 12s. 6d., yielding £2,004,579 of new capital. The bulk of these were offered to shareholders, but 800,000 were subscribed for by Powell-Duffryn Ltd., who became the largest shareholders. In 1950, Powell-Duffryn were appointed technical and commercial managers of Wankie, having previously been consulting engineers and purchasing agents to the company for two years.

At the instigation of the Southern Rhodesia Government, and with the consent of the U.K. Treasury, the control and management of the company were transferred to Southern Rhodesia in 1951. In line with this development, Powell-Duffryn agreed to transfer its management contract to a new locally registered company known as Powell-Duffryn (Rhodesia) Ltd.

The projected programme of expansion included mechanization of underground operations and also the provision of additional amenities for both European staff and Africans. The African labour force was already more than 8,000 and the stabilized African population exceeded 17,000. It was proposed to construct a new African hospital and about 2,000 houses of a standard equal to the best in the Rhodesias.

Although Wankie's coal production of 2,473,000 tons for the year to August 31, 1951, was higher by nearly 10 per cent, the figure fell substantially below expectations based on the extensive mechanization programme. In the following year the output of saleable coal was increased to 2,594,178 tons. Instead of expanding production further by open-cast methods it was decided to open a third colliery. Shareholders were informed that the serious coal shortage throughout the territories could not be completely overtaken until this new colliery came into full operation, bringing the output up to 5,000,000 tons.

Under the management of Powell-Duffryn, Wankie's production has been raised by nearly 50 per cent in three years. Nevertheless, the Board were still faced with the overriding problem of increasing production to meet the growing coal requirements of the Rhodesias. Apart from substantial capital expenditure, this involved the expert supervision of developments under conditions existing in Southern Rhodesia and the recruitment of sufficient supervisory staff and African labour.

Coal mining practice and organization are very different under African conditions from those in the United Kingdom. It was therefore agreed that the solution to the problem of chronic coal shortages in the Rhodesias would best be reached by placing the responsibility for the expansion and organization of the colliery in the hands of the Anglo American Corporation, whose coal department has wide experience in coal mining under local African conditions.

Arrangements were made whereby Rhodesian Anglo American, the Rhodesian investment company of the Anglo American Group, issued 250,000 of its reserve stock units of 10s. each to Powell-Duffryn in exchange for the latter's holding of 800,000 shares of 10s. each in Wankie. Rhodesian Anglo American also acquired from Powell-Duffryn its entire shareholding in Powell-Duffryn (Rhodesia) Ltd. in exchange for the issue of 70,000 stock units of 10s. each. Mr. Coulter was head of the coal department of Anglo American Corporation and managing director of African and European Investment Company, which controls Anglo American Corporation's colliery interests. Recently the composition of the board was broadened to include a representative of the Copperbelt producers outside the control of Anglo American Corporation and a representative of the Union Minière du Haut Katanga.

FUTURE MINING POLICY

On the recommendation of the consulting engineers, the new Board adopted a mining policy comprising:

(1) the introduction of machine mining at Nos. 1 and 2 collieries as soon as possible and the adoption of a production technique similiar to that used in most Transvaal collieries;

(2) the opening and equipping of No. 3 colliery for the production of about 2,250,000 sales tons of coal per annum;

(3) the completion of a large variety of capital items on the surface, including extensions to the coking and by-product plants, power plant, water supply, housing, etc.

Good progress has been made during the current year with the opening and equipping of No. 3 colliery. The main incline shaft reached the coal seam early in November. The production and dispatch of development coal has been started, but output will be restricted by lack of adequate hoisting facilities till early in May, 1954. Thereafter, output from No. 3 colliery should quickly increase to 50,000/55,000 tons per month, remaining around that level until the permanent preparation plant is ready for commission about the end of 1954, when the underground development position should be sufficiently advanced to produce a substantial and immediate rise in output.

During the year ended August 31, 1953, sales of coal rose to 2,781,023 tons. With No. 3 colliery coming into production at an early date and with improved methods at the other two collieries, a substantial increase in output should be achieved during the current financial year.

The expansion programme with all its ancillary requirements is estimated to cost approximately £5,300,000 distributed over the next three years. In order to finance this programme, the authorized capital of the company has been raised to £6,000,000 and the borrowing powers of the directors to a similar amount. Shareholders were invited to subscribe for 2,206,250 shares of 10s. each and £3,500,000 5½ First Mortgage Debenture Stock. When this offer closed on September 21, the whole of the Debenture Stock and approximately 95 per cent of the ordinary shares had been subscribed.

The company's steadily improving position is reflected by the accounts for the year ended August 31, 1953, which show profits from coal mining, coke and by-product production amounting to £465,016, compared with £245,198 earned in the previous year. Provision for taxation absorbed £125,000, leaving a net balance of £340,016. This amount, together with the balance of unappropriated profits, made available a total of £560,098, of which £330,938 was absorbed by dividend payments aggregating 10 per cent. Since 1940, dividends had been limited to 5 per cent annually except in 1949/50, when the payment was increased to 7½ per cent.

NEW PRICE AGREEMENT

A new price agreement operative for 25 years has been entered into between the company and the Government of Southern Rhodesia, covering the terms on which the company will sell its coal in the territories now constituting the Federation of the Rhodesias and Nyasaland. The general principle of the agreement is that of cost-plus-profit, with an additional incentive profit based on a reduction of working costs. The minimum amount to be set aside to reserves by the company out of profits before taxation will be 20 per cent in the financial years ending August 31, 1953/54, 22½ per cent in 1955/56, and 25 per cent in 1957 and thereafter.

To compensate as far as possible for the shortening of the life of the colliery by the increase in coal output to 5,000,000 tons annually, contemplated in the 1950 agreement, the Government will give the company the first option to purchase or lease an area of the surrendered concession. This option will extend the life of the colliery to one hundred years.

The seat of control and management of the company having been transferred to Southern Rhodesia on March 31, 1952, the directors consider that Wankie should now become a company incorporated in Southern Rhodesia. Leave to introduce a Bill was applied for on November 27, 1953, and it is hoped that the transfer will be effected about the middle of 1954.

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London & Rhodesian Mining and Land Co. Ltd.

SINCE its formation in 1909 this company has been prominently associated with the development of Southern Rhodesia. Its direct mining interests in this progressively expanding territory comprise a 100 per cent interest in 526 gold mining claims and a 75 per cent interest in 145 base metal claims. The company also owns well over 1,000,000 acres of land in Southern Rhodesia and is extensively engaged in both ranching and agriculture.

In addition, an investment organization has been built up at the company's headquarters in London which is earning an important revenue from dividends and share dealings.

Finally, the Lonrho group acts for other undertakings, including a group of associated companies headed by Henderson's Transvaal Estates, whose interests are reviewed elsewhere.

Because of its very wide spread of interests the company has been able to show remarkably consistent results over a long period. Despite the difficulties of the gold mining industry and the fall in base metal prices, its untaxed profits for the year ended June 30, 1953, amounted to £98,424 compared with £85,063 in 1952. After providing £44,808 for taxation and transferring £20,000 to general reserve there remained £68,314 for appropriation. The dividend was maintained at 6 per cent per 5s. stock unit on the £1,000,000 issued capital and absorbed £31,500, leaving £36,814 to be carried forward.

A subsidiary company, the African Investment Trust Ltd., which acts as secretary to Lonrho, showed a profit of £6,380, compared with £16,338 in 1951-52, but was able to repeat the previous year's dividend of 5 per cent.

The consolidated income of Lonrho and its subsidiary at £222,062 was higher by £18,065, despite a fall in the earnings of the London office from £74,648 to £66,013. The soundness of the company's investment policy was indicated by increased earnings from dividends and interests, which totalled £42,585 against £39,260 during the previous year. A loss of £7 was incurred on stocks and shares realization account, compared with a profit of some £800 the previous year, but shareholders had been warned by the chairman, Sir Joseph Ball, that it would be unsafe for them to count on the regular maintenance of profits from this source, one reason being that the investment portfolio is becoming more and more stabilized and the necessity for frequent changes is gradually disappearing.

The company's direct interests in mining, ranching and real estate are managed from Salisbury and the revenue from all these sources was appreciably higher. The income from secretarial and engineering fees, commissions, etc., at £56,173 showed a substantial increase. Sales of properties accounted for £22,561 against £459 the previous year, but on the other hand, no income was derived from the sale of mining claims, for which £30,031 was received in 1951-52.

Lonrho's investments include a substantial interest in Henderson's Transvaal Estates, which showed a net profit of £46,704 for the year to June 30, 1953, and paid a dividend of 15 per cent for the seventh successive year. This company controls the Henderson Consolidated Corporation, and among its main assets are the Tweefontein United Collieries Ltd., which produces about 1,350,000 tons of coal per year, and White's S.A. Cement Ltd. Lonrho also has a large participation in Coronation Syndicate, which owns the Muriel, Tebekewe and Arcturus gold mines, all of which are making substantial progress. Other prominent investing holdings are in Cam and Motor Gold Mining and Rezende Mines.

MINING INTERESTS

The profits of the Cam and Motor Mine, which for many years averaged about £25,000 a month, have risen steadily during the past two years to an average monthly figure of over £42,000 in 1953. Recent progress has been due to a higher tonnage milled and to an increased recovery of gold. The mill grade has risen and extraction has improved as a result of the installation of experimental flotation cells in place of slimes tables. As a result of this successful experiment a new flotation plant is being constructed, together with a new slimes plant for the treatment of roaster residue.

A capital expenditure of £101,688 incurred during the year to June 30, 1953, represents the beginning of a larger programme for the reorganization of the mine in keeping with its potentialities. The lowest level is 5,600 ft. below the surface and the virgin rock temperature is 110 deg. F. It seems probable that the mine will extend in depth and a comprehensive scheme for improvement in ventilation is being prepared. At the end of the financial year the ore reserves were computed at 1,405,000 tons averaging 6.6 dwt.

Rezende Mines made a working profit of £35,627 in the year to December 31, 1952, as compared with £15,566 for the previous year. This was due to the higher price received for gold sold on the open market and to an increase in the grade and tonnage milled. The ore reserves were increased by 900 tons and at the end of the year were computed at 204,600 tons averaging 3.8 dwt. per ton.

In view of the good values encountered in the western section of the mine, it has been decided to increase the development in this section. The 650-1,300 incline shaft is being re-opened and re-equipped and it is proposed to install mechanical ventilation. The "Old West" plant is being brought into commission by the installation of an aerial ropeway between the Rezende shaft and the Old West Mill, and it is hoped that when this work is completed the tonnage milled will be increased to 10,000 tons per month. Capital expenditure is being provided from reserves but the cost of the extra development work is being charged against mining costs. This fact, together with increasing costs and difficulties encountered in mining, due to pressure bursts, resulted in a profit of only £3,700 during 1953, a working loss being incurred in December.

During the year to June 30, 1953, 9,006 tons were milled at the Connaught mine, a small producer which Lonrho itself brought to production, and the profit before charging depreciation amounted to £14 910.

An income is also derived from various claims let on tribute, which yielded 9,990 f.oz. of gold during the year, royalties amounting to £17,015 being received.

Lonrho recently purchased for £80,000 a gold mining property in the Jumbo district, some 30 miles north of Salisbury. Known as the Bucks mine, it has hitherto been worked on a small scale but a detailed investigation has revealed encouraging prospects. A Southern Rhodesian subsidiary company with an issued capital of £90,000 has been formed to purchase and operate the mine. The estimated reserves already blocked out and available for immediate mining were calculated at 109,000 tons averaging 7.28 dwt. over 48 in. and the purchase price included all the small-scale equipment already operating on the mine. Mining operations on behalf of the new owners, Mazoe Consolidated Mines Ltd., started in October, 1953.

RANCHING AND TOBACCO

Lonrho's two ranches, Wiltshire and Lochard, together comprise 640,272 acres. In order to overcome the effects of drought large sums have been spent on sinking boreholes and on the construction of dams with capacities aggregating several million gallons. This policy, supported by progressive methods of agriculture and grazing control, has proved very successful, as indicated by profits of £34,596 from ranching operations during the year to June 30, 1953.

On the Wiltshire estate are some 1,000 acres which, when cleared, would be suitable for tobacco growing. During the year under review 125 acres were planted and produced a crop of 71,000 lb. but owing to excessive rains the operating profit amounted only to £1,772. Nevertheless, in view of the much higher yield per acre, there appears to be considerable scope for switching an increasing acreage from ranching to tobacco.

Since it is considered contrary to public policy that any company should hold land indefinitely, unless some prospect exists of being able to develop it for productive purposes, it has been decided to sell at the first opportunity a number of properties producing little or no revenue. Negotiations are in progress for the sale of valuable stands in Bulawayo and Salisbury, with a view to re-investment of the proceeds.

The company's progressive policy in regard to both mining and ranching has necessitated the use of mechanical equipment and transport on a substantial scale. The transport section has hitherto been inadequately housed in a site known as the "old machinery yard" in the centre of Salisbury. A new site has now been obtained in the heavy industry area, where adequate storage and repair facilities are now available for the first time. The former site has thus become available for sale and should fetch a high figure.

Zambesia Exploring Co. Ltd.

THE interests of the Zambesia Exploring Co. lie mainly in Northern Rhodesia and East Africa. This old-established mining finance company was formed in 1891 by the late Sir Robert Williams for the purpose of acquiring mining claims, land and also plots in various Rhodesian towns. In 1899 the company participated in the formation of Tanganyika Concessions with which it has remained closely associated.

To-day the business of Zambesia Exploring is largely concerned with mining finance, and it holds also a 100 per cent interest in The Zambesia Investment Co. Ltd., which was formed in 1950, consequent on the capital reconstruction of Tanganyika Concessions Ltd., to retain as a fixed investment the parent company's holding of Preference shares of Tanganyika and its participation in the Ordinary stock of that company sold by the Bank of England to an Anglo American group. Zambesia Exploring also co-operated with "Tanks" in the formation of Tanganyika Holdings, in which each company has a 50 per cent participation, and to which the holdings of both companies in Rhodesian and East African mining companies were transferred.

Since the business of the parent company and its subsidiary, Zambesia Exploring Co. are of a different nature, the accounts have not been consolidated. The fixed assets of the parent company consist of properties in Africa, its wholly-owned subsidiary, and its 50 per cent interest in Tanganyika Holdings Ltd., all standing at cost in the balance sheet at £817,587. Current assets amount to £575,537. They include quoted investments, at cost, of £401,741, having a market value at December 31, 1953, of £541,648. Cash at bankers and in hand stood at £134,325, and loans, debtors and tax certificates at £39,291.

The parent company's operations are summarized below.

Year to Dec. 31	*Gross Revenue*	*Expenses*	*Taxation*	*Net Profit*	*Dividend*	*Carried Forward*
	£	£	£	£	%	£
1953	112,105	10,662	70,906	30,537	15	42,154
1952	103,469	11,570	62,798	29,101	15	53,602
1951	117,806	11,197	75,000	91,609	20	96,220

The profit after taxation of the Zambesia Investment Co. at £40,864 showed little change from the previous year. No dividend was paid, thereby avoiding distributed profits tax, and the carry-over was in consequence increased from £62,711 to £103,575.

TANGANYIKA HOLDINGS LTD.

This company's assets consist mainly of holdings in Kentan Gold Areas Ltd., the Geita Gold Mining Co., and the Rhodesia-Katanga Co. A profit of £3,132 after taxation was made in the year to June 30, 1953, while the balance sheet showed quoted investments at £139,386, having an actual market valuation of £145,662.

In addition to its title to Kansanshi mine, the Rhodesia-Katanga Company owns in Rhodesia perpetual coal-mining rights in 20 areas of 300 acres each and perpetual mineral rights, including coal but excluding diamonds and precious stones, over 2,500 sq. miles, both subject to 15 per cent interest of the British South Africa Co.

Rhodesia-Katanga participated in the formation of Kansanshi Copper Mining Co. Ltd., to carry out further exploration of the Kansanshi mine, including a deep drilling programme, under the technical direction of Anglo American Corporation. Tanganyika Holdings has undertaken to subscribe at par for a further 41,250 shares of £1 each in Kansanshi Copper Mining Co., on the exercise by the latter company before December 31, 1955, of an option to purchase the Kansanshi mine and the surface rights of the Kansanshi Farm Area.

The principal asset of Kentan Gold Areas is its holding of the issued capital of the Geita Gold Mining Company whose technical advisers, New Consolidated Goldfields, reported that the future outlook for the mine was sufficiently favourable to justify spending about £100,000 on necessary capital works. When the present capital programme has been completed the mine should be able to mill at the rate of 30,000 tons per month, and it is hoped that this target will be reached in the course of 1955.

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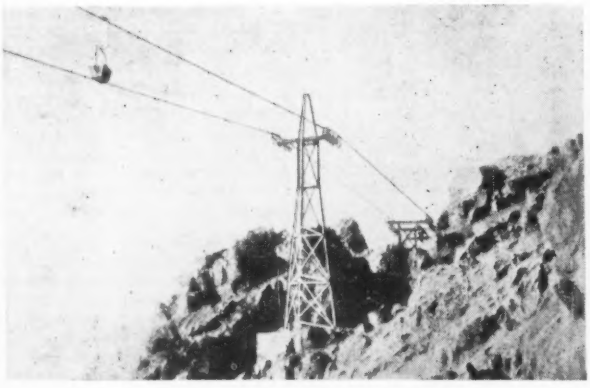

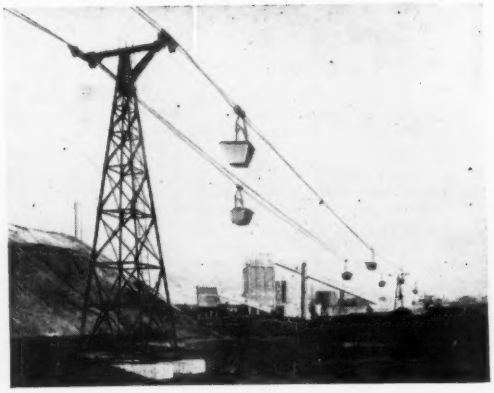

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Tanganyika Concessions Ltd.

THE progress of mining and railway development in Central Africa is reflected by the rising profits of Tanganyika Concessions. Although this well-known company experienced difficult periods before the war, it is now reaping the benefit of a far-sighted policy initiated many years ago.

Tanganyika Concessions was formed by the late Sir Robert Williams, Bt., in 1899, and has carried out much exploratory and development work in various parts of Africa. The cornerstone of its prosperity has been the discovery of important mineral deposits in a concession obtained by Sir Robert Williams in the Belgian Congo. This discovery led to the formation of the Union Minière du Haut Katanga, in which Tanganyika Concessions still has a holding consisting mainly of 179,760 parts sociales as well as 61,384 4½ per cent obligations of B.Frs.100 each. In order to provide an economic outlet for the products of the Belgian Congo and a direct route for imports, the company financed the construction of the Benguela Railway across Angola, which links the harbour of Lobito Bay with the Bas-Congo du Katanga Railway at Dilolo. The line was opened to traffic in 1931.

In November, 1950, the seat of management and control was transferred to Salisbury, Southern Rhodesia, an undertaking being given to H.M. Government that the company would not dispose of its interests in Union Minière or the Benguela Railway Co. for at least ten years, after which any interests disposed of are first to be offered to H.M. Government.

As can be seen from the following table, the change of domicile has been followed by steadily rising earnings and increased payments to shareholders.

Year to July 31	*Total Income* £	*Total Expenses* £	*Taxation* £	*Net Profit* £	*Dividend* %	*Carry Forward* £
1953	2,301,491	99,843	143,734	2,057,914	45	995,999
1952	2,098,697	121,307	150,000	1,827,390	40	809,790
1951	1,272,302	103,671	66,955	1,101,676	25	279,394

UNION MINIÈRE DU HAUT KATANGA

The ability of Tanganyika Concessions to raise its total dividend distribution to 45 per cent in respect of the year ended July 31, 1953, was due largely to a higher total dividend distribution made by Union Minière. Tanganyika Concessions receipts on this account of £1,597,424 against £1,276,657 for the preceding year, reflects the stepping up of Union Minière's distribution from Fr.1,000 to the record total of Fr.1,250. For the first time the tax authorities in Belgium are seeking to collect tax from Tanganyika Concessions on the Royalty received from Union Minière. While provision has been made against this contingency, the claim is being contested.

During 1952, mining development by Union Minière was carried out principally at the Western Mines and development in depth at Prince Leopold Mine at Kipushi. Tonnage of copper and cobalt ores developed exceeded ore extracted during the year. Mine production during the year amounted to 5,758,300 tonnes or ore of various kinds, including copper, cobalt, zinc and uranium ores, as well as limestone and ironstone fluxes for Lubumbashi Smelter. In addition, 10,566,000 cu. m. of barren overburden were stripped from open pit workings. The greater part of the ore mined came from the Prince Leopold Mine and the western group, where Musonoi, Ruwe and Kingamyambo mines were active.

The Kolwezi Concentrator treated 1,602,676 tons of ore and produced 287,997 tons of concentrates containing 27.48 per cent copper and 1.01 per cent cobalt, and 43,071 tons of concentrates containing 8.62 per cent cobalt. The Kipushi Concentrator produced by simple concentration 9,880 tons of concentrates of 23.58 per cent copper and by differential flotation 253,891 tons of concentrates containing 28.92 per cent copper and 189,388 tons containing 52.25 per cent zinc. The cobalt output was also a record at 6,831 tonnes. Production of zinc concentrates totalled 189,388 tonnes containing approximately 98,950 tons of metal; 66,075 tons of raw concentrates were roasted for the production of sulphuric acid; 92,734 tons of raw concentrates and 47,167 tons of roasted concentrates were delivered to Belgian refineries; 20,506 kg. of cadmium were recovered from flue dusts of zinc concentrate roasting furnaces. The Hoboken Metallurgical Co. delivered 147,034 kg. of silver and 54 kg. of gold recovered in refining copper from the Prince Leopold Mine.

Despite lower metal prices, another successful year for Tanganyika Concessions is foreshadowed by further increases in production recorded by Union Minière for 1953. The copper output amounted to 212,500 tonnes compared with 205,750 tonnes in 1952. The production of cobalt reached 8,232 tons—an increase of about 20 per cent. Outputs of cadmium, uranium, radium and precious metals continued at approximately the previous year's levels.

BENGUELA RAILWAY CO.

The net profit of the Benguela Railway Company amounted to Esc.127,781,284 in 1952 as compared with Esc.97,031,154 in 1951, and Esc.67,427,587 in 1950.

Tanganyika Concessions owns all the debentures and 90 per cent of the equity of this now prosperous undertaking, whose importance to Central Africa is self-evident. The financing of this railway is an achievement of which the company can be justly proud. For instance, additional working capital to a total of £1,292,675 was provided during the seven years ended December 31, 1952. Capital expenditure on improvements to the railway and its carrying capacity, financed entirely out of earnings, amounted during this period to £4,021,382. The projected capital expenditure of the railway company for 1953 and 1954 was £2,822,349, making an overall total to the end of 1954 of £6,843,731. It is hoped that the capital expenditure of the railway company for 1953 and 1954 can also be financed out of earnings.

TANGANYIKA HOLDINGS LTD.

Tanganyika Holdings was formed by Tanganyika Concessions and the Zambesi Exploring Co. Ltd. (q.v.) in 1950, each company taking a 50 per cent participation, for the purpose of acquiring the Northern Rhodesia and East African interests of these companies, including Rhodesia-Katanga Co. Ltd., Kentan Gold Areas Ltd., Geita Gold Mining Co. Ltd., and Uruwira Minerals Ltd.

RHODESIA-KATANGA CO. LTD.

The Kansanshi copper mine, owned by the Rhodesia-Katanga Company, is situated in the north-western district of Northern Rhodesia and is being developed by the Anglo American Corporation in association with Tanganyika Holdings, Roan Antelope Copper, Mufulira, Mwinilunga Mines and Rhodesia-Katanga. Progress reports issued by the consulting engineers, Anglo American Corporation of South Africa, have shown mixed results. During the last half of 1953 large inflows of water were encountered and exploratory development was deferred at the Main North Shaft while a pump chamber and a large sump were excavated. However, the latest report covering the period from January 1 to February 20, 1954, revealed some excellent values from groove samples taken in a vein in a crosscut advanced from the Main South Shaft. These values averaged 29.59 per cent copper of which 21.53 per cent was oxide copper but good values of sulphide copper were also obtained.

An option to purchase this property, expiring on December 31, 1955, is held by Kansanshi Copper Mining Co. Ltd.

GEITA GOLD MINING CO. LTD.

The Geita Gold Mining Co. is the principal asset of Kentan Gold Areas, which holds almost 77 per cent of the issued capital. The capital structure of both companies has been disencumbered from all prior charges. New Consolidated Gold Fields Ltd., the consulting engineers to the Geita Company, have acquired a financial interest and now hold 20 per cent of the reconstructed capital of that company.

A substantial increase in the tonnage throughput was recorded for the year ended June 30, 1953—252,000 tons against 212,600 tons. The output of gold was increased from 32,409 oz. to 36,885 oz. and working costs were only 1d. per ton higher. Despite a substantial increase in the development footage advanced (5,635 ft. against 2,358 ft.) the development rate was still insufficient. Ore reserves fell from 1,913,000 tons averaging 3.7 dwt. to 1,240,000 tons, but the average value improved to 4 dwt. New Consolidated Goldfields, the company's technical advisers, are taking steps to accelerate development and grade control is being brought into effect in order to eliminate overmining, mining of unpayable ores, and the dilution of broken rock with waste.

British South Africa Co.

THE year 1953 was a momentous one for The British South Africa Co., for it covered the centenary of the birth of the company's founder, Cecil Rhodes. This occasion was marked by the holding at Bulawayo of an exhibition which was formally opened by Her Majesty the Queen Mother. A key part in organizing this outstandingly successful event was played by the company's resident director, Colonel Sir Ellis Robins, whose strenuous work for the exhibition was suitably recognized by Her Majesty by the conferment on him of the rank of Knight Commander of the Order of the British Empire.

Also of special significance to the company was the Federation of the Nyasaland and the Rhodesias, which, whatever its merits and limitations, is regarded as a vast improvement on the former mutual isolation of these three territories.

Formed under Royal Charter in 1889, The British South Africa Co. has exercised a profound and far-reaching influence on the development of the Rhodesias. For more than thirty years "Chartered" was responsible for the administration of both Southern and Northern Rhodesia. Throughout the period that it was carrying this administrative burden, its shareholders received not a penny in dividends.

In 1923, Southern Rhodesia was formally annexed as a Colony and in the following year the company was relieved of its administrative duties. Under the terms of the agreement, "Chartered" received a cash payment of £3,750,000 and retains until 1964 a half-interest in the net proceeds of the disposal of land in North-West Rhodesia. It also received the Crown's recognition of its mineral rights throughout Rhodesia. In June, 1933, the company's mineral rights in Southern Rhodesia were purchased by the Government of that territory for £2,000,000.

More recently—in August, 1949—an arrangement was reached with the Northern Rhodesian Government, whereby it was agreed that the company should retain its mineral rights in Northern Rhodesia until October, 1986. During this period it is under contract to pay 20 per cent of its net royalty revenue to the Northern Rhodesian Government, such payments ranking as an expense for tax purposes.

It was perhaps inevitable that, in the course of time, The British South Africa Co. should have lost most of the prerogatives held under the original Royal Charter. Yet its fortunes continue to be closely identified with the prosperity of the Rhodesias. At present it has two main sources of income, one being the royalty on Northern Rhodesian mineral output; the other, income from existing investments.

The high price of copper, zinc and lead, resulting from the Korean war, were reflected by the company's earnings from royalties, which rose from £5,500,771 in the year ended September 30, 1951, to £7,066,386 in 1952 and £7,787,440 in 1953. The gross income from investments (before tax) amounted to £1,118,640 in the year ended September 30, 1953, compared with £1,203,218 in the preceding twelve months. The consolidated profit for the year totalled £9,065,687 against £8,399,547, but once more the gain was largely absorbed by taxation, which amounted to £6,030,477 against £5,686,185, including E.P.L. provisions of £1,365,281 compared with £950,000. The net profit was £2,988,143 against £2,674,776, and dividends totalling 50 per cent were paid, compared with 40 per cent in 1952. These payments absorbed £1,806,854 and the amount carried forward was £5,795,846 against £4,614,557 brought in.

An improved liquid position is indicated by a rise in the consolidated assets from £26,710,149 to £29,683,126. This mainly reflects an increase in tax reserve certificates from £2,000,000 to £3,000,000 and cash at £5,106,222 against £4,050,884.

INVESTMENTS

The fact that the mineral rights now held by "Chartered" will expire in some 32 years' time has led to some modification of the company's long-term policy. An annual amount of £50,000 is being written off the book figure of mineral rights so that this item will be amortized in the balance sheet by the time the rights expire. Meanwhile, the company is building up out of profits a much increased portfolio of long-term investments mainly in Southern Africa. It is particularly well placed to pursue such a policy, in view of the gold mining potentialities in the Union and the wide scope which exists for further investment in Northern Rhodesia.

As a result of this policy, investments have been substantially increased since 1951, and now stand at a little under £12,000,000 as against a little under £11,250,000 for the previous year. The book value of the quoted investments is down by £1,700,000 as compared with the position at September 30, 1952. This is mainly due to the transfer of quoted investments to that amount to New Rhodesia Investments Ltd. whose shares are not themselves quoted. Largely for the same reason the unquoted investments shown in the balance sheet have increased from £2,359,516 to £4,871,733, the greater part of the balance being due to an increase of £474,000 in the amount of money out on loan. The market value of the quoted investments at September, 1953, was £9,591,866, comparing with a book value of £7,105,463. A valuation made in March, 1954, of the quoted investments at present held (which have a book value of £8,679,300) amounts to £12,941,400.

The company's current assets at £9,878,700 exceed the previous year's figures by a little over £2,000,000, while the excess of current assets over current liabilities at nearly £2,000,000 exceeds the previous figure by about £600,000.

The British South Africa Co. is closely associated with important South African mining groups. It has substantial investments in the Rand and in the mines along the "West Wits Line," and has acquired holdings in Orange Free State mines. It is also associated with the two big copper mining groups in Northern Rhodesia in prospecting large areas in the north of the territory. In addition, the Rio Tinto Co. has been granted exclusive prospecting rights over three large areas further south, amounting in the aggregate to some 7,500 square miles.

THE RHODESIA RAILWAYS TRUST

One of the company's most important interests is its holding in The Rhodesia Railways Trust Ltd., which now operates exclusively as an investment trust. Out of a total issued capital of 2,005,767 shares, "Chartered" holds 1,627,000 shares of £1 each at a book value of £1,682,746. The market value of that holding at September 30, 1953, was £2,643,875. A dividend of 10 per cent was declared by the Trust in respect of the year ended September 30, 1953.

INDUSTRIAL INTERESTS

The company holds 89,295 ordinary shares of £1 each out of a total issue of 150,000 ordinary shares in Spa Food Products Ltd. It also holds shares to a book value of £1,700,000 in New Rhodesia Investments Ltd., a new company registered in Southern Rhodesia, in which "Chartered" has taken a half interest, transferring to it a number of its quoted investments. Another associated company is the Rhodesian Milling and Manufacturing Co. (PVT) Ltd., whose present policy is the reinvestment of profits for the expansion of its own and its subsidiaries' business. Its Northern Rhodesian subsidiary, the Northern Rhodesia Milling Co. Ltd., has in hand the erection at Lusaka of a warehouse and silos. Another participation of potential value is in Rhodesian Alloys Ltd., a company sponsored by John Brown and Co., the Clydeside steelmasters and shippers, who are establishing a metallurgical works in Southern Rhodesia. The company's assets also include citrus and other estates in Southern Rhodesia, totalling about 100,000 acres. A profit of £55,380, after charging depreciation of £27,358, was made for the 1953 season.

CURRENT YEAR'S OUTLOOK

The current year's outlook is good, although indications are that it will not prove to be as good as the year under review. For example, the company's great interests in the Northern Rhodesian copper producers will yield less in royalty payments as it seems unlikely that the average price per ton of copper produced will equal the figure of approximately £249 per ton attained during the year under review. Nevertheless, the price has held up much better than many expected and with the company's very large and widespread interests, coupled with the fact that E.P.L. will only be operative for three months of the year, Sir Dougal Malcolm in his statement to shareholders at the last annual meeting said he did not anticipate any difficulty in maintaining the dividend at 50 per cent.

The long-term outlook for the future of Northern Rhodesian copper is good, having regard to the improving power supply position and new producers, notably Bancroft Mines, coming into the field. The company is taking all possible steps to encourage new prospecting.

Rhokana Corporation Ltd.

AMONG the largest companies operating in the Northern Rhodesian Copperbelt is the Rhokana Corporation, which is controlled by Rhodesian Anglo American Ltd. Itself one of the world's leading copper producers, Rhokana is also to some extent a holding company, for it is substantially interested in other important undertakings in the Copperbelt. It has extensive holdings in two neighbouring producers, Mufulira Copper Mines and Nchanga Consolidated Copper Mines, both of whom are established dividend payers. It also owns 50 per cent of the capital of Rhodesia Copper Refineries, which was formed in 1947 to refine the joint production of Rhokana and Nchanga.

Rhokana's interests have been further extended by the formation of Bancroft Mines Ltd., which was incorporated in Northern Rhodesia on May 21, 1953, with a nominal capital of £5,000,000 divided into 20,000,000 shares of 5s. each, to develop the Corporation's special grant areas of Kirila Bomwe and Kongola, north-west of Nchanga. The Corporation has subscribed directly for 9,500,000 shares. Bancroft Mines is scheduled to come into production early in 1957 and will operate at the rate of approximately 150,000 s.tons of ore per month, which is expected to result in an output of some 43,000 l.tons of copper per annum. Considerable progress has already been made in the building of houses for European and African employees and shaft sinking has commenced.

Rhokana has a 25 per cent interest in the Rhodesia Congo Border Power Corporation Ltd., which has acquired ownership of the interconnection system and other assets of the Northern Rhodesia Power Corporation. Besides undertaking the distribution of power to the four copper producers, the new Corporation has assumed responsibility for the importation of hydro-electric power from the Belgian Congo, which, it is hoped, will be available early in 1957, and has concluded an agreement with the Export-Import Bank of Washington for loan facilities of up to £8,000,000.

OPERATING RESULTS

Rhokana's production has been restricted by poor coal deliveries and consequent power shortages, and was twice interrupted by strikes. As a result of these difficulties the output of copper during the year ended June 30, 1953, was lower by 8,548 s.tons. It amounted to 74,216 s.tons, consisting of 29,499 tons of blister and 44,717 tons of electrolytic.

Though operations at Rhodesia Copper Refineries were also affected by shortage of power, production of electrolytic copper by this company rose to 111,576 l.tons compared with 102,269 tons in 1951-52. The higher output was due entirely to an increase in cathodes received from the Nchanga leach plant. Considerable progress has been made with plant extensions for producing vertically cast copper, and it is anticipated that these shapes will be available to the market by the middle of 1954.

Production from Rhokana's electrolytic cobalt refinery, which was started in August, 1942, has been restricted by operating difficulties. These have largely been overcome and the total production of cobalt metal for 1952-53 was 259 s.tons. It has become clear, however, that the designed output of the plant will not be achieved without additional roasters, which are being ordered.

The financial results of the year's operations can be regarded as highly satisfactory. Revenue from metal sales advanced to £22,026,344 against £21,135,626. The operating surplus was approximately £9,900,000 which was some £500,000 more—on a slightly reduced sales tonnage—than that earned on a comparable basis in the preceding year, when abnormal sales resulted in an exceptional profit of £640,000. The Corporation's investment income was higher by about £600,000 as a result of increased dividends received from Nchanga.

The profit for the year was £12,610,811, of which taxation absorbed £4,219,784, leaving a net profit of £8,391,027. The sum of £2,800,000 was allocated to general reserve. Although Bancroft was financed out of existing resources, the Corporation was able to repeat the previous year's dividend payment of 225 per cent, which, with the preference dividend absorbed £5,671,126, leaving unappropriated profits of £366,750 compared with £454,349 brought forward.

The company's balance sheet disclosed fixed assets of £19,076,067, being an increase of £2,285,304 on the year, while current assets rose from £15,844,845 to £16,478,791. After providing for the final dividend, net current assets at the year end were approximately £3,300,000, exclusive of a figure of £824,000 shown separately as "Advances," which consists mainly of finance for Rhodesia Copper Refineries and Rhodesia Congo Border Power Corporation.

MUFULIRA COPPER MINES

Rhokana's holding of £2,166,666 represents 26.59 per cent of the issued capital of Mufulira Copper Mines Ltd. A summary of this company's operating results over the past three years appears on the next page.

The transfer of control from London to Rhodesia liberated £1,997,000 previously provided for U.K. income tax, enabling the company's finances to be strengthened by unusually large allocations to replacement and general reserves. The total distribution for the year was again 8s. 3d. per share. After making these dispositions the carry forward was £125,000. For the six months ending December 31, 1953, the estimated profit (before taxation) was £2,794,000.

During the year under review Mufulira's new £4,000,000 refinery came into operation for the first time and by the end of 1952 it was running at its rated capacity of 3,000 tons per month. An extension which will double that capacity is expected to come into operation early in 1956. The company's mine and mill capacity is still rated at 285,000 tons monthly, which is scheduled to increase in 1956 to about 340,000 tons monthly. The ore reserves now stand at 231,730,000 tons.

Development is in progress on the property of Mufulira's subsidiary, Chibuluma Mines Ltd., but despite its great promise it has been decided not to proceed with the Baluba venture at the present time.

NCHANGA CONSOLIDATED COPPER MINES

Rhokana holds £2,355,000 stock in Nchanga Consolidated, representing 33.6 per cent of the issued capital.

New records were again set up by Nchanga during the year ended March 31, 1953. The production of blister and electrolytic copper rose to 93,317 l.tons compared with 68,816 tons in 1951-52, while the tonnage milled during the year was 1,984,400 s.tons at 6.84 per cent copper against 1,512,900 tons at 6.46 per cent copper.

The policy of financing the current capital expenditure programme out of profits was maintained by transferring £3,100,000 to general reserve, which at £7,000,000 now equals the issued capital of the company. The net profit after taxation amounted to £8,748,525, compared with £5,505,600 (after transferring an abnormal profit of £750,000) for the previous year. Dividend payments were increased to 15s. per £1 unit of stock compared with 10s. per unit for the previous year.

It was anticipated that production for the year ended March 31, 1954, would be further increased by the commissioning of the remainder of third stage extensions. Consideration is being given to extension of the present mining methods to include open-pit working, for which the property is reported to be eminently suitable.

FUTURE OUTLOOK

The recent return to a free market in copper has made it necessary for considerably greater stocks to be built up by June 30, 1954, due to a material increase of tonnage in transit between the mine and consumers, but against this contingency there is a Sales Equalization Reserve amounting to £400,000. Since the re-opening of the London Metal Exchange the price of copper has remained steady at satisfactory levels and contracts have been finalized for a substantial part of the Corporation's output in future years. Production is being steadily expanded, and both technically and financially a very strong position has been achieved. With improving coal and power supplies, the outlook for Rhokana and its associated companies in the Copperbelt seems very favourable, given freedom from industrial disputes.

In terms of the Rhoanglo Group Act which received Royal Assent on May 6, 1953, the control of Nchanga was transferred to Northern Rhodesia early in 1954 and it is intended to re-incorporate the company in Northern Rhodesia before paying the maintained interim dividend of 10s. per unit in respect of the current financial year ending June 30, 1954.

Roan Antelope Copper Mines Ltd.

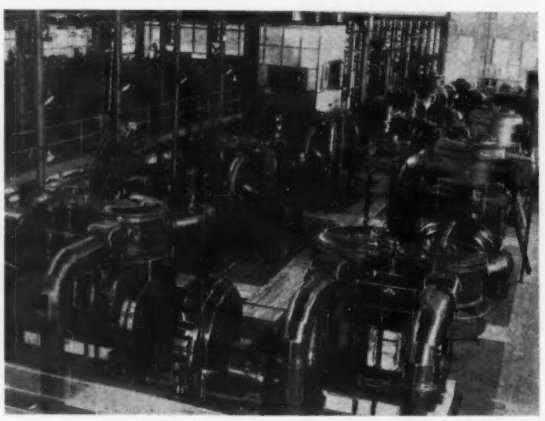
THE establishment of production and financial records of Roan Antelope Copper Mines Ltd. during the year to June 30, 1953, would normally be sufficient evidence of the Company's progress to attach particular significance to the year's operations. However, these were but two of the events which justify Mr. R. L. Prain's assertion in his Annual Statement that "The past year may by any criterion be regarded as an historic one for the Company, and also there occurred certain events which will have far reaching effects on the future of the company and the Rhodesian Copperbelt generally." It witnessed the transfer of control from London to Rhodesia of Roan Antelope and Associated Companies; the return to free dealings in copper on the London Metal Exchange after nearly 14 years of U.K. Government bulk buying; the Federation of Rhodesia and Nyasaland; and finally, the initiation of talks on the industrial colour bar.

Roan Antelope				Mufulira		
50/51	51/52	52/53	Output and Unit Costs	50/51	51/52	52/53
3,970	4,368	4,846	Tons milled (000 s.tons)	3,325	2,923	2,963
74.5	81.0	87.3	Blister prod'n (000 l.tons)	86.7	76.4	76.1‡
176.2	205.9	248.6	Revenue per ton (£)	174.9	205.9	249.2
98.2	103.2	147.0	*Cost per ton (£)	82.4	102.6	156.8
78.0	102.7	101.6	Profit per ton (£)	92.5	103.3	92.4
			Financial Results (£000)			
13,243	16,826	22,111	†Revenue	15,017	16,020	18,669
5,953	7,190	9,686	Operating Cost	6,048	6,683	8,133
7,290	9,636	12,425	Surplus	8,969	9,337	10,536
36	111	241	Investment Revenue	49	102	218
114	170	154	London expenses, including Dirs'. remuneration	97	137	140
1,250	1,000	3,000	Replacements Reserve	1,000	1,000	3,000
45	45	45	Loan Stock Interest	32	32	32
—	—	—114	Misc. items (+ or —)	—13	—	—115
5,917	8,532	9,353	Profit before tax	7,876	8,270	7,467
4,121	5,889	4,565	Taxation	5,112	5,652	3,842
48	73	2,165	Taxation adjustment for previous years	10	655	1,997
Dr.	Cr.	Cr.		Dr.	Cr.	Cr.
201	674	2,801	Reserves	1,086	1,496	2,786
1,546	2,123	4,213	Dividend	1,765	1,765	2,811
+1	—81	—61	Carry Forward (+ or —)	—95	+12	+25

*Including production, selling and admin. costs and replacements reserve.
†After adjustment for increase or decrease in blister stocks.
‡Primary Production.

While the accompanying table faithfully registers the production and financial records achieved it does not indicate that the tonnage milled and hoisted was accomplished in spite of a three-week strike of African employees at the end of 1952, and of recurrent fuel shortages. Nor does it clearly convey the favourable impact on the financial results of the transfer of the Company's control from London to Rhodesia which liberated £2,165,000 previously provided for U.K. Income Tax and materially assisted the large allocations, shown in the table, to be made to Replacement Reserve and to General Reserve. Aside from the Company's own plans for extensions and improvements designed to maintain its earning power and ability to treat lower-grade ore and lower-grade matte, the intention to construct an electrolytic copper refinery in the near future in Northern Rhodesia was recently announced by the Company. The refinery will be owned by a new company to be called Ndola Copper Refineries Ltd., of which the Company will take up the ordinary share capital. The Company will also enter into a long-term contract to supply the refinery with up to 60,000 tons of blister copper per annum for refining into electrolytic shapes which will be sold.

The outlook for the current year must take into account delivery delays occasioned by the need to establish "pipelines" to consumers in the United Kingdom and the United States of America following the resumption of free dealings last August. Revenue from sales during the first nine months of the Company's current financial year has been adversely affected by this process but the Company expects that the position will be corrected by the close of the year when excess stocks are converted into deliveries.



The Roan Antelope power plant, showing compressor and turbine aisle

While the copper price has fallen somewhat from the levels existing during 1952/53 any shortfall in revenue from copper sales will be cushioned by a reduced allocation to reserves, smaller royalty payments and a lighter taxation burden. The technical position of the mine is sound and production costs have been stabilized around £125 per ton while fuel supplies are protected until 1956 when power will be available from the Belgian Congo.

Yet underpinning the future of the Company—and that of the Copperbelt if not, indeed, the whole of the Federation, is the need to find a solution to the labour problem. The foundation stone of Federation was partnership between the African and the European and its realization in practice is essential to the future prosperity of the new Central Africa. The question is still "sub judice" and comment is therefore premature.

Mufulira Copper Mines Ltd.

THE events which made 1953 an historic year for Roan Antelope Copper Mines Ltd. apply equally, of course, to Mufulira Copper Mines Ltd., 64 per cent of the issued capital of which is held by Rhodesian Selection Trust Ltd.

On the other hand, the three-week strike of the African employees and the recurring fuel shortages hit Mufulira particularly severely as Mufulira is a wet mine with a high pumping load and must therefore carry greater stocks of fuel against such emergencies than other Copperbelt mines. In fact, the Company estimated that the strike and the fuel shortages resulted in a loss of about 14,000 tons production. Yet if the Company did not break any production or financial records its results were eminently satisfactory as the accompanying table shows. As in the case of Roan Antelope the transfer of control from London to Rhodesia liberated previous tax provisions made for U.K. income tax amounting to £1,997,000. This non-recurring windfall enabled unusually large allocations to be made to the Replacement Reserve and to the General Reserve.

The most outstanding feature of the Company's operations during the year ended June 30, 1953, was the coming into production of its £4,000,000 refinery. Cathodes were first pulled in November 1952 and by the end of the year the tankhouse was running at its rated capacity of 3,000 tons per month. The ultimate capacity of this plant, which is double this figure, is expected to be attained early in 1956.

During the year under review further progress was made in developing its wholly-owned subsidiary, Chibuluma Mines Ltd., and it is now anticipated that production will begin during the latter part of 1955 instead of 1956 as originally planned. Confidence in Chibuluma's future was re-affirmed in May 1953 when the original estimate of £3,600,000 to equip and to develop the mine had to be re-adjusted to £6,000,000 owing to the substantial unforeseen increases in the cost of equipment, raw materials, labour and advances in town planning desiderata. The Defense Materials Procurement Agency of the U.S. Government accordingly increased its unsecured loan from £3,000,000 to an upper limit of £5,000,000, and Mufulira increased its shareholding in the Company from £600,000 to £1,000,000. The loan is repayable in metals and D.M.P.A. has a prior option on 19 per cent of Chibuluma's cobalt output compared with the 10 per cent originally envisaged.

Mufulira continued its investigations into its large cobalt-copper property, Baluba, to determine the physical characteristics of the ore body. Unfortunately, these turned out to be such that actual production would be limited to about 100,000 tons per month, equivalent to about 24,000 tons of copper per annum, which could not provide a sufficiently large profit margin for the mine to carry safely a capitalization of approximately £13,000,000, if the bulk of that capital is formed by means of loan capital. Attention continues to be given to Baluba's future.

The outlook for the current year depends on roughly the same factors as those affecting Roan—the settlement of the labour question and the establishment of the pipelines to its consumers. It must be mentioned that both Mufulira and Roan have placed with consumers substantially the whole of their estimated production at prices which are to be determined on delivery.

Selection Trust

THE power and influence of Selection Trust arises less from its capital resources—impressive though they are—than from the long recognition accorded the company by virtue of the dynamic policy it has always pursued.

Indeed, its present stature has been built up on solid achievements, of which perhaps the most outstanding was its pioneering work in the Northern Rhodesian Copper Belt, and the subsequent formation of Roan Antelope and Mufulira Copper Mines. The Trust also brought to fruition Trepca, the well-known lead-zinc mine in Yugoslavia, now nationalized, and the important West African diamond producer, Consolidated African Selection Trust. More recently it participated in the financing of the very rich base metal producer, the Tsumeb mine in South West Africa.

The foregoing in no way exhausts the list of the Trust's successes and interests, which are widespread. The company was among the first of the influential mining houses to take an active interest in the Orange Free State goldfields and it still retains its interests in farms north of the Sand River and, with Union Corporation, in certain blocks adjoining the property of Western Reefs Exploration and Development Company. Its principal shareholdings in the Orange Free State are in St. Helena, which has been making very satisfactory progress, Western Holdings, whose rich strike in a borehole intersection in January last of 7.518 in. dwt. provided a preview of the mine's potential worth, and Vaal Reefs, in which the Trust acquired a substantial interest last November by arrangement with Anglo American Corporation of South Africa.

The Trust's main investment interests are, however, held through its subsidiary, Seltrust Investments, in which it holds all the issued ordinary capital and 20 per cent of the issued redeemable preference shares.

This subsidiary holds all of the issued capital of the South African incorporated African Selection Trust (Pty.) Ltd. and valuable interests in Tsumeb Corporation and Western Holdings. But its chief assets are its holdings of 680,683 shares of common stock in American Metal Company and 1,900,000 stock units of Consolidated African Selection Trust. On the basis of stock exchange prices at March 31, 1953, the value of the quoted investments held by Seltrust and its wholly-owned subsidiary was £8,019,802.

The American Metal Company carries on a base metal mining, smelting and marketing business chiefly through subsidiaries, or agencies, in which it holds large interests. It owns 32.65 per cent of the capital of Roan Antelope Copper Mines and 50.61 per cent of the capital of Rhodesian Selection Trust whose principal holding is a 64 per cent share interest in Mufulira Copper Mines. For the year ended December 31, 1953, the American Metal Company reported a net income of $10,037,231 out of which dividend payments totalling $1.50 per common share were paid, and a stock bonus of 5 per cent was distributed. In 1952 the same dividends were paid out of net income amounting to $9,990,831.

Always on the look out for new and potentially promising mining propositions, Selection Trust established in March, 1953, a Canadian subsidiary known as Selco Exploration Company Ltd. which is actively investigating mineral possibilities in Canada; while in November last, Bikita Minerals (Private) Ltd., at that time a subsidiary of the company, exercised an option on a lithium-beryllium property in Southern Rhodesia about 45 miles from Fort Victoria. Participating in this latter venture are The American Metal Company, American Potash and Chemical Corporation and Trepca Mines. The interest of Trepca arises through its working agreement with Selection Trust, under which it is offered a 20 per cent participation in all new mining business undertaken by the Trust, while the latter is entitled to 10 per cent of Trepca's net annual profits and also has the right to subscribe for 1,000,000 Trepca shares at par and a further 1,000,000 shares at 6s.

During the year to March 31, 1953, the gross revenue of Selection Trust and its subsidiaries totalled £1,994,467 compared with £1,991,674 for the previous year. Outgoings were slightly less and after providing for all expenses, including £1,145,877 for taxation, the net profit for the year was £752,841 compared with £896,857. The Ordinary dividend payments totalled 42½ per cent against 45 per cent and required a net £517,153.

The consolidated balance sheet showed investments with a total book value of £2,680,507 and current assets of £3,630,737 of which cash resources accounted for £3,051,463. Current liabilities amounted to £650,962. During the current year an interim dividend of 12½ per cent has been paid in respect of the year to March 31, 1954, the same as was paid during the year under review.

Consolidated African Selection Trust

PRIOR to 1953, investment income of Consolidated African Selection Trust was no more than could reasonably be expected from a company which is by far the largest single producer of diamonds—both gems and industrial—in British West Africa.

Broadly speaking, investment income even in peak years represented less than 10 per cent of the profit received from its diamond mining activities. But during the year ended June 30, 1953, "Casts," to use its more familiar market name, increased its investments by no less than £558,825 to £735,771 which resulted in an expansion of investment income by as much as £373,561 to £555,201 representing over 25 per cent of its earnings from diamond production and trading which totalled £2,186,600.

Thus the company's revenue is now derived from three main sources; directly from its mines in the Gold Coast; indirectly from diamond mining operations carried out in Sierra Leone by its wholly-owned subsidiary, Sierra Leone Selection Trust; and thirdly, from investments.

Diamond mining operations in the Gold Coast are centred around the Birim river area and the output averages about 85 per cent industrial stones. One drawback of the company's large concession area, covering some 70 square miles, is that it is thickly wooded, and as the Africans have been allowed to take out diggers' licences on the very borders of the company's main operating zone the difficulty of preventing illicit mining and theft is obvious. The company, with the full co-operation of the Gold Coast Police, have been taking vigorous action to reduce the depredations and for the first time for some years illicit mining activities were not specially mentioned by the chairman in his statement to shareholders. On the other hand, Mr. A. Chester Beatty, Jnr., devoted his attention to another menace, the New Minerals Duty which is not susceptible of Double Taxation Relief, and has the further distinguishing mark that its incidence increases directly in proportion to the efficiency of operations, or to the richness of the deposit discovered. During the year to June 30, 1953, the first full year in which the Minerals Duty was applicable, it absorbed £209,612. This was additional to the £335,000 absorbed by the Gold Coast in other tax charges and to the £128,000 taken by the United Kingdom, so that after allocating £150,000 to reserves there was an available surplus of only £90,000 out of a net out-turn of £951,000—a meagre return indeed for the technical skills and money which the company has spent in building up its business, since it was first formed in 1924.

The diamondiferous gravels of Sierra Leone, where the company's wholly-owned subsidiary, Sierra Leone Selection Trust, holds the exclusive right to produce diamonds, carry a much higher proportion of gem material than in the Gold Coast. That gem stones are found in greater abundance in this colony has obvious advantages for the company but it also carries with it the disadvantage that it offers even greater attraction for thieving and illicit diamond mining operations. These activities are carried out on a fairly large scale and the company estimated that depredations of one sort or another during the year under review caused a reduction in their sales amounting to approximately £430,000. In any event, the surplus from diamond sales for the year was £1,338,000 of which £386,819 was realized from the sales of diamonds out of wartime reserve stocks to counter the loss from theft. Taxes absorbed £611,000 leaving a net balance of £371,000.

With regard to the third main source of "Casts" revenue, investments, a substantial proportion of the additional capital invested during the year was absorbed by the acquisition of shares in The Diamond Trading Co. Ltd. and The Diamond Purchasing and Trading Co. Ltd., the two companies concerned with the marketing of gem diamonds. This investment is similar to the company's previous purchase of a shareholding in Industrial Distributors (1946) Ltd. which is concerned with the distribution side of industrial stone production.

The salient features of the consolidated profit and loss account are given in the following table and call for little comment save that the reduction in the dividend from 80 per cent to 75 per cent was more a matter of prudence than necessity as the large allocation to reserves and the strengthened forward balance amply testify.

Year to June 30	*Working Profit*	*Taxation*	*Net Profit*	*Dividend*	*To Reserve*	*Carry Forward*
	£	£	£	%	£	£
1953	2,463,872	1,412,000	1,051,872	75	550,542	303,235
1952	2,192,797	1,453,125	739,672	80	152,267	158,484
1951	2,697,422	1,716,786	980,636	100	484,093	118,032

The outlook for the current year is good, but indications of a slackening in the demand for industrials continue. This will not affect the disposal of the company's available production, the whole of which will be absorbed under its selling contracts.

Ashanti Goldfields Corporation Ltd.

MOST situations, whatever their complexity, are usually amenable to simple analysis *ex poste facto*. But it is precisely because this is so that often gives rise to unwarranted criticism. The extensive post-war development programme undertaken by Ashanti Goldfields Corporation is a case in point.

The heart of the matter is that the Corporation cut its dividend distribution from 50 per cent to 40 per cent during the year ended September 30. 1953, and many found this difficult to reconcile with the exceptionally rich reef strikes announced throughout the year and in the following six months. The seeming paradox of "richer than ever" reef developments being accompanied by a lower total distribution is easily resolved, however, when the extensive post-war development programme undertaken by the Corporation is considered.

POST-WAR DEVELOPMENT PROGRAMME

Ashanti, then, for all practical purposes, may be considered as three separate sections, governed by the present location of ore reserves with each served by its own shafts. The Cote d'Or Reef is worked in the South Shaft Section, the Obuasi South Reef in the West Shaft Section while the Main and Timber Shafts have provided access to the Main Reef which is, of course, the reef channel below the junction of the Cote d'Or and Obuasi Reefs. The post-war development programme was designed to provide facilities by which these three sections could be fully exploited but especially in the Main Reef Section.

Generally speaking, the programme was dictated by the technical position which was the direct effect of the war-time policy which had necessitated stopping all shaft sinking and exploratory development while maintaining a high level of gold production. By the end of the war ore reserves had been much depleted and new levels in depth were needed to provide replacements but before this was possible a heavy programme of shaft sinking was essential. More than any thing else the ventilation of the mine had become an acute problem and called for immediate action.

The position at the bottom of the mine where on the lower level, No. 32, the evidence was of diminishing ore bodies, presented a difficult problem. It was obvious that if the mine was to continue below that depth then a new deep shaft, large enough to replace the existing Main and Timber Shafts, which had outlived their usefulness, would be needed. Before embarking on such a large undertaking, however, it was felt that more substantial evidence than was then available should be furnished to justify the new shaft. This involved continuing exploration below No. 32 by sinking a small sub-vertical shaft from that level.

First priority was given to the question of ventilation and an upcast circular shaft, 18 ft. in diameter and concrete lined, was sunk to a depth of 1,778 ft. and equipped with a siutable fan. Without this provision subsequent development and production would not have been possible. West Shaft, which was commenced prior to the outbreak of war and then suspended, was needed for the development of the Obuasi South Reef. Sinking was resumed in 1945 and was continued at a rate to suit the development possible, but planned with No. 20 Level as its maximum depth.

In the Main Reef Section the scope for development was large but the rate at which it could be carried out was limited by the inadequacy of the Main and Timber Shafts which had also to maintain output. The prospects of success were stronger in this section and it was therefore decided to sink the South Shaft to No. 32 Level to augment the hoisting capacity. This sinking was completed at the end of 1953, since when the arrangements for hoisting ore have also been completed and the shaft brought into full service in April, 1954.

Meanwhile the amount of exploration done in depth, limited though it was, has been sufficient to increase reserves of high grade ore in that part of the mine and at the same time has furnished important information on the reef below No. 32 Level.

The completion of the South Shaft to operate from Level 32 completed the first stage of the extensive development programme and it will now be possible to increase the amount of work done in the Main Reef Section where the prospects of developing new ore reserves are most promising. To effect this as expeditiously as possible, main exploratory levels, later available for haulage, are being driven at intervals of 300 ft., the intermediate development of the ore shoots being from connecting winzes. This work is expected to produce sufficient new ore to ensure production pending the completion and commissioning of the all-important Eaton-Turner Shaft. The sinking of the West Shaft to Level 20, completed in March last, marked the end of the second stage of the programme and will enable the reefs at the south end of the mine to be efficiently exploited.

IMPORTANCE OF EATON-TURNER SHAFT

Important and necessary as these two stages in the development programme have been their significance for the future prospects of Ashanti living prosperously at depth is small in relation to the role of the Eaton-Turner Shaft and the developments associated with the sub-vertical shaft. As mentioned above, the reef at the north end of the mine below Level 32 had not been explored and to achieve this a small sub-vertical shaft was sunk to Level 38 from which Nos. 33 and 35 Levels have been developed northwards to assess the richness of the area. Fortunately, and indeed spectacularly, the reef values encountered were generally excellent with some of the reef strikes yielding phenomenal results. For example, in March last, a cross-cut driven north-east on Level 35 gave the astonishing result of 150.9 dwt. over a reef width of 15.5 ft., equivalent to 28,067 in. dwt. Naturally, even the most insensitive shareholder was excited so that when the Corporation reduced its dividend an explanation was in order. Part of the answer is, of course, that the lower levels of the mine from which these results were obtained can only be explored and at present cannot be exploited until the Eaton-Turner Shaft is sunk to its final depth of 4,200 ft.

The Eaton-Turner Shaft is circular with a concrete lining and a finished diameter of 18 ft. It will have a hoisting capacity of 120 tons per hour so that it can deal comfortably with 30,000 tons per month. Additionally, it will also serve as the main fresh air intake for the mine. Actual shaft sinking operations are expected to be completed sometime in the first half of 1955 but the installation of guides and other shaft equipment will take another two or three months. Intensive development will then take place on selected levels while the shaft bottom is being completed and the Corporation is not, therefore, anticipating its making a major contribution to increased output until 1956. At April 30, 1954, the shaft was down to 2,260 ft.

The other half of the reason why the distribution was cut stems from the fact that shaft sinking operations are costly and that since the war Ashanti has spent no less than £618,000 on shafts and as much as £1,302,000 on plant and equipment. What is more to the point, the whole of this amount was found from its own resources. This has enabled the issued capital figure to be kept low but it has also meant that the company's resources have been absorbed to meet this capital expenditure involved rather than being paid to shareholders by way of higher dividends. The foregoing must, of course, be an oversimplification of the whole story as it does not begin to tell of the restrictions on development work in certain areas of the mine necessitating thereby increasingly larger amounts of ore to be treated from the lower-grade outside mines and quarries such as Ayeinm, Sansu, Justices and Blackies which has lowered the average grade of ore milled.

Nevertheless, the major portion of the programme has now been completed and results ere long should begin to show the benefits of this large capital expenditure programme. In fact, there were some encouraging pointers in this direction in the report and accounts for the year ended September 30 last, the salient features of which are given in the table below.

OPERATING RESULTS

Year to Sept. 30	*s.tons milled (000)*	*Grade (dwt.)*	*Yield (oz.)*	*Cost* per ton* s. d.	*Bullion† Proceeds* £	*Other Income* £	*Mining Costs* £	*Other‡ Costs* £	*Taxation§* £	*Free Balance* £	*Dividend* %	*Pension Fund* £	*To Reserves* £	*Ore Reserves* *Tons (000)*	*Ore Reserves* *Grade (dwt.)*
1953	281.0	14.4	180,218	69 5	2,343,234	31,189	1,151,401	199,633	684,716	338,673	40	16,400	47,591	1,408.4	19.0
1952	226.9	16.2	165,913	70 9	2,165,843	32,348	967,586	175,713	718,127	336,765	50	14,218	34,772x	1,410.4	18.8
1951	237.6	17.2	188,339	57 11	2,359,642	42,245	852,857	165,816	1,003,412	379,802	50	13,654	38,402	1,506.9	18.4
1950	218.6	19.0	189,815	59 7	2,297,148	37,655	792,778	149,304	729,046	663,675	62½	13,000	192,369	1,616.4	18.5

* Excluding development charges. † Less realization charges. ‡ Depreciation and general expenses. § Including Gold Coast Government Royalty and Gold Duty
x Taken from reserve.

Tonnage milled was an all-time record at 281,021 tons of which 203,086 tons came from the Ashanti Mine, 22,027 tons from Ayeinm, and the balance, 55,908 tons, from the outside mines. While the increased output from the outside mines is reflected in the reduced overall grade milled it contributed approximately 12,000 oz. of gold more than was possible from the Ashanti Mine. Another significant feature was the reduction in working costs per ton milled by 1s. 4d. to 69s. 5d. and development costs by 2s. to 12s. 6d. per ton. The outlook for the current year in the circumstances cannot be viewed as particularly bright. Expenditure on shafts and capital appreciation must continue into 1955 and depreciation will absorb more of the company's earnings until this expenditure becomes revenue producing. Thus it is only natural that a conservative dividend policy will be followed while this drain on the company's resources continues and the rate of dividends will depend, as Major General Sir Edward L. Spears said in his statement accompanying the report and accounts, declared that a determined is being made to enable more gold to be produced.

During the first seven months of the current year estimated profits, subject to taxation, amounted to approximately £445,077 compared with £537,812 in the corresponding period of the year under review.

Bibiani (1927) Ltd.

"PRODUCTION control" has for so long been the operative phrase used to describe operations at Bibiani (1927) Ltd., that it seems quite natural for the consulting engineer in his report on operations during the year ended September 30, 1953, to conclude with the words, "There has been no outstanding feature in the year's work. Production and progress have been steady and the outlook remains so"

One of the aims and objectives during the year under review was to establish a mill throughput of 30,000 tons per month or 360,000 tons per annum for a recovery of 75,000 oz. In the event, 362,580 tons were crushed yielding 75,005 oz. Despite the fact that of the total tonnage treated 103,513 tons came from the surface quarry averaging 2.75 dwt. per ton, the overall average grade of ore treated rose from 4.4 dwt. to 4.5 dwt. which enabled gold production to reach 75,005 oz., the highest output achieved since 1946.

Satisfactory as the above results must be, working costs, compounded as they are in mining of so many variables and therefore not amenable to even reasonable control, showed a further rise, this time from 37s. 8d. to 40s. 9d. and represents the seventh year in succession that an increase had been incurred. This figure includes a charge of 3s. 6d. per ton for mine development, and must also take into consideration that salaries of Europeans were raised last year and that, generally speaking, prices of mining stores have shown a tendency to rise. But even so, the problem of the mine's cost structure is serious and Major General Sir Edward L. Spears, in his statement accompanying the report and accounts, declared that a determined effort was being made to reduce them.

IMPROVED MINING METHODS

The underground workings are in good order, and it is by introducing improved mining methods that the company hopes to exact the greatest contribution towards lowering its working costs. The chief change in underground mining methods has been the switching over from "cut and fill" mining to a system of shrinkage stoping which requires a faster rate of mining and practically no timber supports are necessary. Progress made during the year with this new method was very satisfactory and tungsten-carbide tipped bits were used with jackhammers and air-legs to obtain a marked improvement in the tonnage broken. The "shrinkage" method of mining entails more ore being broken than is hoisted as the balance remains until the block is completely mined when the residual ore can be drawn off as required. This causes a temporary rise in costs which is offset when the remaining broken ore is recovered. Bibiani Mine has now reached the stage when the reserves of broken ore allow for a reduction in current breaking and improvement in working costs.

The company is also preparing large blocks of ore for bulk mining on the same principles as sub-level caving which, roughly speaking, is a method by which a delimited ore body is extensively drilled and blasted in a manner which allows the ore body to be drawn out in controlled stages. More specifically, this method is being used on the No. 15 level block which, as reported in the preceding year, is 450 ft. in length and is situated between Levels 12 and 15 and is estimated to contain some 280,000 tons of ore. This has involved the adoption of long-hole drilling techniques which have been effected by means of extension steels and tungsten carbide bits used in conjunction with the normal drifting machines. Some 40,000 tons were extracted from this ore block during the year under review. However, the operation is controlled and the tonnage extracted bears no relation to the extent of the production possible. A second block of ore is being prepared between Levels 15 and 18 and the company anticipates that with the improvements in the layout, the cost of preparation will be less and the drilling simplified.

UNDERGROUND DEVELOPMENT

The total footage advanced during the year was less than in previous years owing to the large amount of other excavation work found necessary in connection with pumping and other essential services. The total footage accomplished declined from 30,781 ft. to 21,094 ft. of which 11,280 ft. were done on mine development account and the remainder being largely concerned with stope preparation.

The results achieved were mixed, the most important work being accomplished on Level 19 where the south ore body has still not been fully explored. On this level the ore shoot seems to have lengthened although the value and the width is lower. At the end of September last, a total of 575 ft., averaging 8.2 dwt. over a width of 17.5 ft., had been proved compared with 400 ft. and 10.6 dwt. over a width of 26 ft. on the above level.

On the upper levels at the north end of the mine results were not so satisfactory—so far at any rate as the values reported on Level 10 in the preceding year of a 450 ft. strike averaging 6.3 dwt. per ton over a width of 14.5 ft. have not been confirmed either above or below this level on the scale hoped for. Yet much work remains to be done on these levels before any definite conclusions can be reached and a decision taken as to their possibilities.

In any event, the new ore being developed more than replaced that mined during the year. Moreover, the development programme is being intensified in order to complete this important exploration work, and it is also expected that Level 20 will be partially developed during the current year.

The bulk of the new ore developed during the past two years has been at the bottom of the mine and has been of a grade higher than the average of the mine as a whole. While the overall grade of the company's ore reserves has been kept at a steady level it is now essential to mine these relatively high grade ore blocks in order to maintain gold production. Accordingly, stopes are being prepared in readiness for the Central Shaft skips to operate from the loading pocket now being installed at Level 19.

For the first seven months of the current year gold production totalled 44,005 oz. for a profit, subject to taxation, of approximately £55,901 which compares with an output of 42,946 oz. and a profit of approximately £87,329 in the corresponding period of the year under review.

OPERATING RESULTS

Year to Sept. 30	*s.tons milled (000)*	*Grade (dwt.)*	*Yield (oz.)*	*Cost* per ton* s. d.	*Bullion† Proceeds* £	*Other Income* £	*Mining Costs* £	*Other Costs* £	*Taxation‡* £	*Free Balance* £	*Dividend* %	*Staff Assurance Fund* £	*To Reserves* £	*Ore Reserves* Tons (000)	*Ore Reserves* Grade (dwt.)
1953	362.6	4.5	75,005	40 9	970,874	3,298	740,937	95,626	63,000	74,609	10	7,244	39,865	1,782.7	5.5
1952	363.3	4.4	71,440	37 8	921,842	4,666	685,192	81,329	52,050	107,937	17½	8,180	42,170	1,766.2	5.4
1951	352.6	4.6	74,868	35 6	922,169	5,018	625,755	79,320	110,639	111,473	20⅝	8,975	47,810	1,764.4	5.4
1950	33.4	4.8	73,996	32 7	922,311	4,057§	559,083	72,101	141,311	177,373	25	7,401	90,497	1,759.8	5.3

* Including development charges. † Less realization charges. ‡ Including gold duty paid to the Gold Coast Government.
§ Excluding £23,500 received on insurance claim.

Gold Coast Selection Trust Group

AS the prospects for a higher gold price grew dimmer in 1953 the West African gold share market continued to be out of favour. The abolition of E.P.L. at the end of the year had some effect on markets, but any expectations of relief from this source were overcome by the more immediate problems of a diminishing revenue from the sale of gold on the free market owing to the slackening in demand, and by a continuance in the unending spiral of increased costs. Price changes in the commodity markets have brought some relief, however, and increasing competition for business will probably help those who are forced to buy industrial equipment. But the more permanent factor in West African costs, as elsewhere, is in wages.

GOLD COAST SELECTION TRUST LTD.

Over the past few years opportunities for making money by share dealings in the West African markets have been few, consequently Gold Coast Selection Trust's income from this source is only a fraction of what it used to be. This diminution in revenue has been largely made good by an increased contribution from interest and dividends. In the year to September 30, 1953, share dealing brought in a little more than in the previous year and income from interest and dividends was slightly down. Neither movement was, however, significant. On the expenditure side, the only change of note was a decrease in the tax liability. Owing to tax losses brought forward from previous years the company is able to recover from the taxation authorities the bulk of the tax deducted at source on the dividends received.

Amalgamated Banket Areas, one of the securities in Gold Coast Selection Trust's portfolio, raised its dividend during the latest financial year to 5 per cent against 2½ per cent and this should be increased still further when all the benefits from the re-organization are being felt. Ariston Gold and Bremang Gold have kept their payments unchanged; Gold Coast Main Reef is paying 7½ per cent dividend, and this, it is hoped, will be raised when the present development programme matures. The return of Marlu Gold Mining Areas to the dividend list after an absence of 13 years occurred too late to help Gold Coast Selection Trust in its latest complete financial year, but it will help to swell the income for 1953/54. The 5 per cent dividend from the Ankobra River Power Co. is a welcome addition to the company's finances, but probably the more important function is the provision of power to help the various operating companies in their work.

Gold Coast Selection Trust has a substantial interest in companies producing columbite, the metal in increasing demand for jet aircraft. At the moment columbite is attracting a very high price, and certain grades above a given level are being paid a 100 per cent bonus. The Trust is interested in three producers, Bisichi Tin Company (Nigeria), Gold and Base Metal Mines and United Tin Areas of Nigeria. These three companies have contracted forward to sell all their columbite produced up to the end of 1956. When the advantages of full columbite production at the enhanced price percolate through to the Trust, dividend income should receive a useful boost, and this will be made even larger by the recovery in the price of tin during the first part of 1954.

The holdings in these tin-columbite producers were made in accordance with the declared policy of spreading the Trust's interests over a wider field, both geographically and economically. Now that this policy is being implemented, it has been decided to change the name of the Trust to Western Selection and Development Co.

Year to Sept. 30	*Dividend Income*	*Sales of Investments*	*Tax*	*Net Profit*	*Dividend*	*Retained*
	£	£	£	£	%	£
1953	106,753	3,715	1,628	87,746	15	25,871
1952	110,630	2,357	9,187	83,517	12½	34,298
1951	86,628	19,449	10,753	87,983	12½	38,651
1950	113,373	28,514	31,774	102,492	7½	71,555

MARLU GOLD MINING AREAS LTD.

On the financial side the most important feature of Marlu Gold Mining was the payment of a dividend of 5 per cent for the year to September 30, 1953, after an absence of dividends for almost 14 years. The size of the new dividend rate is on the small side but shareholders will probably not complain at that; they are faced with other problems on the physical side. Chief of these is the difficulty arising from the ore reserves. The structure of the ore plus the deleterious nature of the ground have forced the engineers to revise their estimates and scale down the ore reserves. At the end of 1951-52, the ore reserves stood at 1,573,500 tons with an average value of 4.01 dwt., of this amount 1,092,000 tons, with an average value of 2.68 dwt., were in oxidized ore, and the remaining 481,500 tons were in sulphide ore with an average value of 7.3 dwt. The revised estimates have reduced these tonnages to 596,240 tons of oxidized ore with an average value of 2.86 dwt. and 86,850 tons of sulphide ore with an average value of 5.69 dwt. As the mill treated 498,500 tons of ore during 1952-53, it is clear that the present ore reserves amounting to 683,090 will not last eighteen months, though as the average value of the reserves is 3.22 dwt., against 2.0 dwt. treated during the past year, the amount of bullion produced should be much higher, and this will be made more sure by the discovery of a new reagent which will greatly assist the treatment and recovery of gold from the oxidized zones.

At the last annual meeting, the chairman said that there was little prospect of finding on the existing properties any additional payable deposits, though he emphasized that it was the board's intention to mine all profitable gold from the property and proposals were under consideration for furthering the profitable life of the company.

With the end of mining on the existing property in sight, a review of the balance sheet is highly necessary. Investments standing in the books at the end of September, 1953, at £66,858, had a market value of only £17,411. Current assets were valued at £456,299 and current liabilities at £108,706 leaving net current assets at £347,593 as compared with the issued capital of £2,000,000. It is debatable how much could be realized on the fixed assets, which stood in the books at £1,711,348.

AMALGAMATED BANKET AREAS

The story of Amalgamated Banket Areas for the year to September 30, 1953, must be pieced together from the quarterly reports as the full accounts and report are not yet available.

The quarterly reports give, however, certain important indications. Though the tonnage milled increased from 636,000 to 721,000, gold production did not expand proportionately because the grade dropped back from 3.255 dwt. to 3.1 dwt., but part of the disadvantage from this reverse was offset by the sale of all gold produced in the premium markets. Consequently, bullion revenue rose from £1,343,562 to £1,458,246.

OPERATING RESULTS FOR THE GROUP'S PRODUCING MINES IN WEST AFRICA

Company	*Year Ended*	*Tons milled* (000)	*Grade* (dwt.)	*Yield* (oz.)	*Cost* per ton* s. d.	*Bullion† Revenue* £	*Other Income* £	*Mining Costs* £	*Other Expenses* £	*Gold Duty* £	*Tax* £	*Net Profit* £	*Dividend* %	*Carry Forward* £
Marlu Gold Mining Areas	30/9/53	498.5	2.0	49,421	18 11	641,266	3,767	471,480	49,002	Nil	1,177	123,374	5	125,799
	30/9/52	477	1.9	43,796	20 4	594,691	696	485,158	62,218	Nil	Nil	48,011	Nil	57,425
Amalgamated Banket Areas ..	30/9/52	636	3.4	103,523	33 11	1,343,562	900	1,000,407	204,236	Nil	Nil	139,819	2½	196,559
	30/9/51	657	3.0	93,749	26 8	1,159,412	766	763,999	168,682	Nil	Nil	227,497	Nil	202,867
Ariston Gold Mines	30/9/53	346	7.5	117,138	59 3	1,524,068	17,860‡	990,956	181,765	11,398	223,306	145,901	30	44,084
	30/9/52	330	7.6	114,932††	56 11	1,495,005	4,241	911,699	178,319	19,810	253,787	155,441	30	56,025
Gold Coast Main Reef.....	30/6/53	104	8.5	40,449	80 1	531,851	2,950	381,972	71,207	Nil	45,002	36,620	7½	31,177
	30/6/52	102	8.2	36,965	70 10	472,700	1,066	327,033	73,052	Nil	19,621	54,060	7½	38,435
Bremang Gold Dredging	31/12/52	7,034•	2.6§	34,969	0 10••	459,360	6,108	290,627	46,967	3,252	86,855	64,767	7½	20,572
	31/12/51	8,184•	2.6§	40,861	0 9••	510,739	2,510	300,810	41,551	24,005	146,738	58,654	7½	41,964

‡ Including 384 oz. recovered from by-products and including £11,577 fire insurance claim
§ Grains recovered per cu. yd.
•• Cu. yd. treated
†† Including 456 oz. recovered from by-products
• Including development charges
† Less realization charges

Mining costs increased by a larger amount than the expansion in bullion revenue, rising from £1,000,407 to £1,148,703. The final net profit will depend on the size of other expenses, which are not ascertainable by outside commentators. In past years these other items have come to a formidable total, but it is doubtful whether they will cause the dividend to be reduced from the 5 per cent of 1951-52. During the year the ropeway connecting the Central Milling Plant with the Fanti mine was completed and after the initial teething troubles were overcome, ore is being satisfactorily transported.

Now that Fanti is re-opened, maintenance costs of that mine will be eliminated and instead there will eventually be a revenue coming in. Already there is evidence that the maintenance drain has been plugged up for whereas £89,448 was spent in the four quarters of 1952-53, nothing was spent in the first quarter of the current year. In that period, 200,191 tons were milled against 173,621 tons in the corresponding period of 1952-1953, and as the grade has recovered to 3.23 dwt. bullion revenue was buoyant. Mining costs were, however, heavy, presumably because of the change-over at Fanti from development to stoping, and working profits were very little different from those earned during the last half of the latest financial year.

ARISTON GOLD MINES (1929) LTD.

Ariston's expansion programme continues to make good progress; once again the milling record set up in the preceding year was smashed in the following year; the 1951-52 record of 330,430 tons having been surpassed by the milling of 346,360 tons in 1952-53. A new high was also set up by the production of 117,138 oz. of gold, as compared with 114,932 oz. in the preceding year. This expansion in output was not proportionate with the increase in milling, since the average amount of gold at 6.764 dwt. was slightly below the excellent level of 6.957 dwt. in 1951-52.

While these very satisfactory returns were being made, the average gold premium was only 9d. per oz. below the level of 1951-52. Thus the revenue side of the financial accounts for the year to September 30, 1953, made a good start, and revenue from sundry sources—helped by £11,577 fire insurance claim—amounted to £17,860 against £4,241.

This satisfactory series of good revenue figures has been accompanied by a sequence of greater mine expenditure. In the latest year, the increase was of the order of £79,000, and this was much bigger than the improvement in revenue. But as the Gold Coast Government suffered a cut of £8,500 in its receipts of mineral duty, and a diminution of £26,000 in tax and as the U.K. Government took £30,000 less in taxation, net profit amounted to £145,901, a decrease of about £9,500. This result made no change in the year's dividend, the 30 per cent total of 1951-1952 being maintained.

Since the end of the financial year under review, the company has gone on making new production records, and in February these were accompanied by better financial results. In the latter months of the calendar year 1953, the premium on gold sales had virtually disappeared and this was having a great effect on profits. The operations of the Johnson concentrator will have the desired effect of reducing costs. The objective will be nearer of attainment, however, when the new 40,000 tons winder starts operating, an event expected in August.

GOLD COAST MAIN REEF LTD.

The Gold Coast Main Reef mine consists chiefly of three sections, Tuappim to the south has the highest grade ore in reserve; Bondaye is the most developed section and Ekotokroo has ore only little inferior to that at Tuappim but more exploration of the reef requires to be done on this property. To the north of the Bondaye and Ekotokroo properties lies the ground belonging to Ariston Gold Mines, and in an effort to pool the knowledge accumulated by the two mines concerning their common reef, the management was combined.

The increase in the tonnage milled by Gold Coast Main Reef during 1951-1952, after a five-year period of contraction in the amount treated, is seen to have been no flash in the pan, for in the year to June 30, 1953, the tonnage rose again, reaching 103,633. Of even more importance was the further improvement in the head value of the ore treated from 8.23 dwt. to 8.74 dwt. and in the recovery from 88.28 per cent to 89.35. Thus the physical results were satisfactory enough, and though labour costs have risen largely from an increase in African wages and to a lesser extent in European salaries, gross profits were more favourable in 1952-53 reaching £81,622, against £73,681.

At this stage the tax collector appears. Instead of providing £18,201 as in 1951-1952, the company put aside no less than £45,002. It would seem that the tax allowances which permitted the company to escape liability in 1949-1950 and 1950-1951, have been largely, if not completely used up, and that in future the company will be paying tax at the high rates now taken as normal. Despite the consequent fall in net profits, the dividend was maintained at 7½ per cent, a sign, it would appear, of confidence in the future.

The chairman, while avoiding complacency, looks forward to a continuance of profitabe operations for many years to come. With ore reserves at the end of June, 1953, standing at 398,918 tons with an average grade of 8.64 dwt., and with the present underground development programme leading up to an even higher productivity of the mine, that assessment seems fair enough.

BREMANG GOLD DREDGING CO. LTD.

Although the full story of Bremang Gold Dredging during the year to December 31, 1953, must await the publication of the report and accounts later in the year, the quarterly reports provide a sufficiently good guide to show that 1953 was again slightly less successful than the previous year.

The amount of ground treated fell by about 8 per cent to 6,452,100 cu. yd., but an increase in the grade absorbed some of this fall, the production of gold in 1953 being 30,759 f.oz. as compared with 32,829 f.oz. in the previous year. In these circumstances there will be little surprise that working profits dropped by £30,000 to £130,000, this figure being subject to depreciation, London Office Charges, taxation and gold and mineral duties. Not all this contraction in revenue will be felt by the company, for it is probable that the Gold Coast gold duty will be smaller and that the tax authorities will suffer a diminution in income from this source.

A cut-back in gold production was not entirely unexpected for although Bremang had one of its four dredges out of commission for nearly six months in 1952, it was expected to lose production from this same dredge for nine months or so of 1953. As events turned out, the transfer of No. 2 dredge from the Ankobra River to the Bremang Extended Areas (Offin) took longer than had been expected, the dredge not starting operations until the beginning of 1954. The delay is undoubtedly disappointing for the loss of production of one dredge for a whole year is no small matter, but the transport of the dismantled dredge over a distance of 56 miles over West African roads must be classed as a major operation.

The early months of 1954 have seen the position deteriorate still further, but later in the year, the benefits from working the No. 2 dredge should be felt. The addition of the Extended Areas will lengthen the life of the mine considerably.

SUMMARY OF OPERATIONS SINCE DATE OF LATEST PUBLISHED REPORT AND ACCOUNTS

Company	*Period*	*Tons Milled*	*Grade (dwt.)*	*Yield (oz.)*	*Bullion Revenue* £	*Mining Costs* £	*Working Profit* £	*Capital Expenditure* £	*Available Ore Reserves as at last Published Report*		
									Tons (000)	*Value (dwt.)*	*Width (in.)*
Marlu	6 months to 31/3/54	234,240	2.00	23,416	290,375	212,595	77,780*	Nil	683	3.22	—
Amalgamated Banket..	12 months to 30/9/53 6 months to 31/3/54	721,370 400,835	3.079 3.221	111,082 64,563	1,458,246 806,534	1,143,657 683,213	314,589† 123,321†	104,314 17,189	3,979.2 —	3.76 —	— —
Ariston	6 months to 31/3/54	189,630	6.501	61,640	771,083	498,385	272,698†	48,369	2,871	6.72	134
Gold Coast Main Reef.	9 months to 31/3/54	83,413	8.173	34,086	432,013	295,545*	136,468†	12,578	399	8.64	66.4

* Including development charges
† Excluding development charges

Esperanza Copper and Sulphur Company, Ltd.

Directors:

A. H. WILLIAMS, M.Inst. Pet., A.M.I.M.M. (Chairman & Managing), P. A. ASHMEAD-BARTLETT, A.C.G.I., C. J. BUSBY, O. V. G. HOARE, Lt. Col. J. H. LEVEY.

A MINING proposition of interest outside the well-known mining fields, is the Limni Mine in Cyprus, now being worked by Cyprus Sulphur and Copper Co., of which Esperanza Copper and Sulphur Co. owns 99.8 per cent of the issued capital, or 195,820 shares out of a total issued capital of 196,196 shares of £1 each.

The Cyprus Sulphur and Copper Co. (which was incorporated in Cyprus in 1940) owns and operates the Limni Concession covering an area of approximately 30 square miles. The area is held under a 25 year lease from the Cyprus Government and expires on October 24, 1973, but is renewable for a further period of 25 years.

The Concession is known to contain orebodies having economic values of sulphur, copper, zinc, gold and silver, of which substantial reserves have now been proved. The major part of the Concession is as yet undeveloped. The position as at March 31, 1953, was that the company had partially developed the Limni and Kinousa areas both by shallow drilling and underground development. The new area of Evloimeni, one mile from the Limni opencast operation, is now being examined.

LIMNI, THE ORIGINAL MINE

Limni was the original mine developed and at March 31, 1953, ore reserves were estimated at 5,741,400 tons. Of this total, 1,000,000 tons were semi-oxidized ore overlying the main sulphide formations and, in general, contains both pyrites and copper ore together with a gold and silver content.

THE KINOUSA SECTION

The Kinousa section, where underground mining commenced in April, 1952, carries medium grade copper and zinc ore and relatively high sulphur content. Ore reserves at September 1, 1953, were estimated at 323,790 tons containing an average of 2.37 per cent copper, 3.37 per cent zinc and 43.63 per cent sulphur. An adit haulage has been driven, and two shafts have been sunk to the required depth. Stoping, using the top slicing method, was in progress throughout the year under review.

THE EVLOIMENI SECTION

The Evloimeni section, regarding which, the first announcement appeared in the September, 1953, progress report, appears to have an orebody similar to that at Kinousa, as good values of copper, zinc and sulphur have been encountered.

In common with the developing mines in the O.F.S. the company, from the outset, has adopted a pay-as-you-develop policy. While this has proved successful, the commencement of ore shipments indicated in no uncertain terms that the erection of its own treatment plant in Cyprus for the production of copper and pyrite concentrates, was the correct policy for the company to adopt. A plant to treat the Limni semi-oxidized ore is now nearing completion.

THE OUTLOOK

The outlook for the year ended March 31, 1954, is satisfactory as 31,750 tons of cupreous ore have already been shipped, and for the year ending March 31, 1955, the company will have the benefit of production from the new mill. The company has concluded two important contracts, one for three years to supply German buyers with high grade run-of-mine Kinousa ore, and, the second, for the sale of the whole of the pyrites concentrates accruing from treatment in the new mill. Additionally, no difficulties should be encountered in disposing of the copper-gold concentrates from the same mill.

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The Finsbury Pavement House Group of Nigerian Tin Companies

GOLD and Base Metal Mines of Nigeria, one of the leading Nigerian tin producers since its formation in 1934, announced in 1953 that in future it would be concerned as much, if not more, with the production of columbite as with the production of tin. That the company was in a position to declare a major change of policy at that time was due to a mixture of fact and foresight, the successful combination of which will place the company among the world's leading columbite producers by the end of 1955.

Conscious of its susceptibility to fluctuations in the tin price and having already produced small amounts of columbite from its leases at Rishi and at Liruei-n-Kano, the company's plans to become a substantial producer of columbite crystallized following the U.S. Government's offer to producers of columbite to pay a bonus amounting to 100 per cent of the base price which is on a sliding scale according to grade.

The offer was announced in May, 1952, at which time the company's properties comprised mainly tin. Accordingly, the company negotiated for the acquisition of certain adjoining leases in the Liruei-n-Kano District held by Gold Coast Selection Trust and by United Tin Areas for the sum of £280,000 and shares to the nominal value of £43,843 in the capital of

CORRECTION

We regret that the last paragraph on page 243 under the heading "United Tin Areas of Nigeria Ltd." has become misplaced. In fact, it refers to the financing of the expansion programme being undertaken by Gold and Base Metal Mines of Nigeria in connection with the expansion of that company's columbite production. The misplaced paragraph, therefore, should have appeared following the fifth paragraph in the first column on page 243.

was the sale to [illegible]
Dress leases for approximately £40,000. Gold and Base retains its tin leases at Delimi, Jemaa and Kassa.

Subsequently the company negotiated a further contract with the U.S. Government securing advances up to £100,000 to finance the development and expansion of columbite production from the Rishi leases and at the end of 1953 a total of £175,400 had been drawn under the two loan contracts. These advances are to be repaid in columbite on the same price basis as the sales contract which, in effect, means that columbite having a grade of 73 per cent delivered either for sale or for repayment before June 30, 1955, will be credited at £2,180 per s.ton and at £2,107 for deliveries by December 31, 1956.

The latest accounts to hand cover the calendar year 1952, the essential features of which were that a net profit, after all charges including £53,000 for taxation, of £33,109 was earned on a production of 570 long tons of tin concentrates and 30 s.tons of columbite. The dividend was repeated at 15 per cent.

The report and accounts for the year 1953 will suffer from the lowered tin price and the decline in output by 18 tons to 552 tons but columbite production, which rose to 93 tons, should go a long way to offset this adverse feature.

The outlook for 1954 is much brighter. All the heavy earth moving equipment has arrived on the properties; the main and vital water storage dam at Liruei is completed; and although optimum production cannot be reached until the rainy season, output for the first four months of the current year at 35½ s.tons compares with 22½ s.tons produced in the corresponding period of 1953. Tin production during this period was 165 long tons compared with 188 long tons a year ago. Estimated columbite production for 1954 is about 140 s.tons rising to 220 s.tons by 1955.

UNITED TIN AREAS OF NIGERIA LTD.

Although United Tin Areas of Nigeria is primarily concerned with the production of tin, for the past three years it has been producing small amounts of columbite, and when its present plans mature, this side of its mining operations will figure much more prominently. The company also has monazite in its dumps. Another string to its bow is its investments which, at June 30, 1953, stood in the balance sheet at £78,518. Of this total, £50,900 represented the book cost of its holdings in Esperenza Copper and Sulphur and in Gold and Base Metal Mines of Nigeria, having a market value at the same date of £99,033. Unquoted investments of £27,618 represented its interests in Mines Development Syndicate (West Africa), which it formed in association with seven other companies including Gold and Base Metal Mines and Ex-Lands Nigeria.

During the year ended June 30, 1953, a net profit, after providing for all charges including tax liabilities of £5,474, was earned on a production of 130 tons of tin and 16¼ tons of columbite. A dividend of 7½ per cent was paid per 2s. 6d. stock unit.

During the first nine months of the current year, output totalled 70 tons tin concentrates and 1½ tons of columbite concentrates compared with 109 tons tin and 12 tons columbite in the same period a year ago.

To provide part of the funds required in this expansion programme the company in November, 1953, issued 1,649,258 shares of 2s. 6d. each at 2s. 9d. per share, thus raising the issued capital to £600,000.

THE BISICHI TIN COMPANY (NIGERIA) LTD.

The Bisichi Tin Company (Nigeria) is not only one of the largest tin producers in Nigeria but is also one of the oldest established producers of columbite.

During the year 1952 the company overhauled its contract system of labour and this was chiefly responsible for the decline in the output of tin concentrates from 672 tons to 556 tons and in the production of columbite from 166 tons to 155 tons. Nevertheless, what was lost by the reduced output of tin was made up by additional receipts from its columbite production and the net profit for the year, after providing for all charges including tax liabilities totalling £189,000, of which £27,000 represented E.P.L., was £81,670 against £88,307 in 1951.

The dividend distribution was raised 10 per cent to 35 per cent per 2s. 6. share on the £460,000 issued capital and £57,206 was carried forward against £61,786 brought in.

Tin production in respect of 1953 showed a further small decline to 538 tons but columbite production advanced to 209 tons, the highest in the company's history, which should go a long way towards offsetting the lowered tin price prevailing throughout the year. During the first four months of 1954 tin production at 189 tons and columbite production at 73 tons showed an improvement of 9 tons and 25 tons respectively over those attained in the corresponding period of 1953.

EX-LANDS NIGERIA LTD.

Perhaps the best indication as to the nature and the extent of the tin-winning operations carried out by Ex-Lands Nigeria is its forecast of a production of 900 tons tin concentrates during 1954 and 1,000 tons in 1955. This will represent an appreciable increase on its output during 1952 and 1953 which amounted to 620 tons and 646 tons respectively.

To achieve this object the company at the beginning of 1954 issued £125,000 6 per cent Five-Year Registered Convertible Notes carrying an option to convert into the ordinary shares of 2s. each at the price of 2s. 6d. per share at any time before December 31, 1958, if the notes had not been redeemed beforehand. The net proceeds of the issue, amounting to £120,000, was to assist in meeting the capital expenditure incurred totalling £140,000 on plant and machinery in recent years, the largest portion of which the company financed out of its own resources, and also to meet the amount payable to Gold and Base Metal Mines for the purchase of that company's Dress leases.

The company is one of the lowest cost producers in Nigeria and obtained a working profit of approximately £80 per ton of tin concentrates with the price of tin metal at £600 per ton.

For the last three years 50 per cent dividend distributions have been made.

The Jantar Nigeria Co.

THE Defence Materials Procurement Agency offer to pay a 100 per cent bonus per ton for columbite in addition to a basic price, which in the case of Jantar Nigeria was £1,040 per ton for the calendar year 1952, was announced at the end of May, 1952. But columbite eligible for the bonus payment in 1952 had to be received c.i.f. New York by September 30, 1952, so that of the company's total columbite output of 214 tons only 108 tons qualified for the bonus. Moreover the bonus payment on this tonnage was not received until after the company had closed its accounts for that year. Thus when Jantar submitted its report and accounts for the year ended September 30, 1953, a further 54 tons had qualified for the bonus which, incidentally, had advanced £11 per ton to £1,051 per ton. The bonus payment on the 108 tons and on the 54 tons brought in a total of £169,005, less Royalty payments to the Nigerian Government amounting to £31,982, leaving a net bonus revenue of £137,023.

Year to Sept. 30	*Production Tin* (*tons*)	*C'bite* (*tons*)	*Ore Sales** £	*Mining† costs* £	*Taxation* £	*Net Profit‡* £	*Dividend* %
1953	212	210	257,675	159,913	155,745	69,610	50§
1952	258	214	334,337	140,503	120,947	66,214	35¶
1951	266	232	311,544	132,982	99,652	72,357	35

* After adjustment of opening and closing stocks, less freight, royalties and insurance but excluding 100 per cent bonus payments per ton columbite.
† Including depreciation
‡ Including bonus payment of £137,023 received from D.M.P.A.
§ Per 2s. 6d. stock unit on issued capital of £225,000 as increased by 66 2/3 per cent share bonus in September 1953
¶ Per 3s. stock unit on issued capital of £135,000

The significance of this additional revenue can be easily assessed for its exclusion from the accounts would have shown the company's untaxed profit for the year at £97,762 which hardly compares with the profit, before tax, of £193,834, achieved in the preceding year. Indeed, Mr. C. A. P. Tarbutt, chairman, in his statement accompanying the accounts points out that these are the two profit figures which should be compared. That being so, the decreased earnings reflect the smaller output of tin and the lower price of the commodity, besides the considerable increase in mining costs. Taxation charges were heavier by £34,798, the increase being largely accounted for by E.P.L. which was operative for a full year and took £23,700—or the maximum amount permissible of 10 per cent of the total chargeable profits. The net profit, including the revenue from bonus payments of £137,023 received from D.M.P.A., showed an improvement of some £3,000 over the preceding year and after paying 1s. 3d. per 2s. 6d. stock unit on the £225,000 issued capital, and allocating £25,000 (£40,000) to general reserve, the forward balance was reduced to £1,547 compared with £9,010 brought in.

But the company is also in the process of shaft sinking prior to commencing underground mining. This is known as the Basalt Lead operation and initial shaft sinking started in 1952. During the year under review, the shaft was sunk to a depth of 89 feet where solid bedrock was reached. This work, as expected, proved to be exceedingly difficult and its completion opens the way to sinking the shaft to the maximum depth considered necessary and to cut the drainage drive for a distance of 600 feet under the Basalt Lead, both of which developments the company hopes to complete by the end of the current financial year ending September 30, 1954. If the extraction of the wash is then proved possible, lode mining will commence.

Future prospects for Jantar should prove to be unusually interesting. Apart from the projected lode mining scheme, the company hopes to have its new treatment plant in operation by the end of the current year as well as the new gravel pump equipment for working the columbite areas in the Kuru Valley. In order to bring its issued capital of £135,000 more into line with the actual value and earning capacity of the assets employed in the business, the company capitalized £90,000 of its reserves in September of last year by issuing to shareholders one new fully paid share of 2s. for each 3s. stock unit held; converted the shares into stock units, consolidated them with the 3s. units and sub-divided the then 5s. units into two units of 2s. 6d. each. The net result was to raise the issued capital to £225,000, its present figure.

The output of tin and columbite for the first six months of the current year amounted to 102 tons and 106 tons respectively, compared with 110 tons and 114 tons respectively in the corresponding period of last year.

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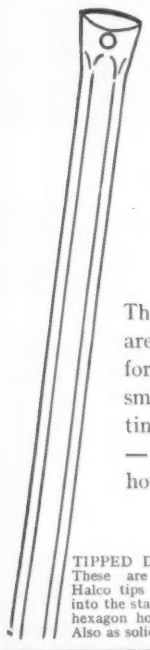

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Kaduna Prospectors Ltd.

ALTHOUGH the cash price of standard tin for the year 1952 averaged approximately £964 per ton, a decline of about £113 per ton compared with 1951, price fluctuations during the year were relatively narrow. During 1951 the cash price fluctuated between £805 and £1,620 per ton—a range of £815—as against a peak of £1,005 and a trough of £917, or a range of only £88 per ton in 1952.

Year to Dec. 31	*Output (tons)*	*Sales (tons)*	*Per ton ore (price)* £	*(cost)* £	*Tin Sales* £	*Ore Reserves (tons)*
1952	77	75	688	332	51,615	247
1951	69	66	742	292	48,997	283
1950	84	80	607	235	48,574	306

During the year ended December 31, 1952, the average price realized by Kaduna Prospectors for its sales of tin concentrates was £688 4s. per ton compared with an average price received in 1951 of £742 7s. 7d. per ton, a decline of only £54 per ton of concentrate. This may be compared to a decline in the average market price of tin metal from £1,077 to £964 per ton —a fall of £113 per ton of metal, equivalent to about £80 per ton of tin concentrate.

The company produced 8 tons more than in 1951 and as a result of selling 75 tons (9 tons more than in the previous year) tin proceeds completely offset the lower price prevailing and actually showed a small improvement on the 1951 figures.

This is clearly brought out in the table immediately above, which shows, however, that this result was achieved by drawing on ore reserves to the extent of 52 tons of the total production. That only 25 tons were mined from outside the ore reserves was probaby a smaller tonnage than the company would have wished but even so, at the current rate of production ore reserves are sufficient for over three years.

The salient features of the profit and loss account set out below show that revenue for the year 1952 advanced by £2,884 over the preceding year. On the other hand, total outgoings rose by £5,663, which position, though ameliorated by the lower off-take in taxation by £976, was not fully offset, so that the net profit figure was down by £1,803 compared with 1951. Yet the statistical summary presented does not tell the full story as the company was able to augment this net figure by the sum of £500 received from a life assurance policy and by the receipt of £1,125 from the sale of an investment. Accordingly, a net balance of £5,303 was achieved.

Year to Dec. 31	*Gross Revenue* £	*Total Expenses** £	*Taxation* £	*Net Profit* £	*Dividend (net)†* %	£	*Carry Forward* £
1952	52,638	39,160	9,800	3,678	33⅓	3,604	2,990
1951	49,754	33,497	10,776	5,481	33⅓	5,250	3,540
1950	49,273	29,227	11,956	8,090	33⅓	5,500	3,125

* After adjusting for opening and closing stocks. 1952 - Cr. £1,960; 1951 - Cr. £3,300; 1950 - Cr. £1,075.
† Issued capital at December 31 1952 - 200,000 2s. shares or £20,000; 1951 - 200,000 3s. shares or £30,000; 1950 - 120,000 3s. shares or £18,000.

A net £3,604 was distributed to shareholders, £2,000 was appropriated as a provision for profits tax arising from the repayment of capital (during the year the company repaid 1s. per 3s. share, thereby reducing its issued capital from £30,000 to £20,000 which became effective on December 15, 1952), and £249 to write off the balance of expenditure on prospecting the Niger River area, a venture that is described in greater detail in the article regarding the Kaduna Syndicate, Ltd. The final result, therefore, was that in order to meet these provisions and charges it was necessary to draw £550 from the amount brought in, so that the forward balance was lower by that amount compared with the preceding year.

During the year ended December 31, 1953, tin production totalled 116 tons, an increase of 39 tons over the total recorded during the year under review and the highest obtained since 1942. This expansion should go a long way towards offsetting the lower average price per ton ruling throughout the year.

In respect of 1953 the company has declared an interim dividend of 8¼ per cent per 2s. share on the £20,000 issued capital which compares with the corresponding payment of 12½ per cent in the preceding year.

The Kaduna Syndicate Ltd.

THE KADUNA SYNDICATE, which has the same board of directors as Kaduna Prospectors, is three years older than Kaduna Prospectors, having been registered in 1910 to acquire and work certain alluvial tin-bearing areas in Nigeria, and conducts its tin winning operations on a much larger scale.

Not unnaturally, the policies of the two companies follow somewhat similar lines allowing, of course, for the difference in their size and capital structure, so that it will not be out of place to describe in this article a venture in which both companies participated. This was a prospecting scheme in which the two companies, together with Maroc Ltd., investigated a part of the Niger Valley in 1951 by aerial survey and by geological ground survey for which the services of an eminent geologist were obtained to report on the mining possibilities of the area. Although the initial report submitted suggested that gold in payable quantities was present, subsequent preliminary sampling and drilling operations proved otherwise and the three companies abandoned the project.

Year to Dec. 31	*Output (tons)*	*Sales (tons)*	*Per ton ore (price)* £	*(cost)* £	*Tin Sales* £	*Ore Reserves (tons)*
1952	271	225	687	272	154,503	1,101
1951	258	264	736	257	194,481	1,240
1950	317	320	584	199	186,840	1,321

Although the company produced 271 tons of tin in 1952, or 13 tons more than in the previous year, its sales (225 tons) were less by 39 tons, and this, together with the lower average price received per ton, readily accounts for the decline in revenue from the sale of its tin concentrates. These points are clearly indicated in the above table which also shows that production costs were extremely well held. In fact mining costs, including a higher depreciation provision of £3,177 against £2,867, and rail freight, forwarding charges and assays, amounted to £117,229 compared with £117,730, a decrease of £501. This played an important part in keeping total costs down, so that with income tax charges reduced by £14,300, the net profit for the year was not much more than £4,000 below that achieved in 1951. Moreover, this net figure was increased by the sum of £1,000 received from the proceeds of a life assurance policy and by £1,377 from sales of investments, thus bringing the net balance up to £22,898. A sum of £1,800 was transferred to general reserve, which had been reduced from £17,500 to £8,200 by appropriating £9,300 to provide for profits tax arising from the repayment of capital. The balance of expenditure, less receipts, on the Niger River prospecting venture, namely £249, was written off. The dividend of 75 per cent on the reduced capital was equivalent to 37½ per cent on the doubled capital in 1951 and the balance, £12,651, was carried forward.

Year to Dec. 31	*Gross Revenue* £	*Total Expenses** £	*Taxation* £	*Net Profit* £	*Dividend (net)†* %	£	*Carry Forward* £
1952	159,126	103,905	34,700	20,521	75	19,500	12,651
1951	198,651	124,869	49,000	24,782	50	25,200	11,302
1950	190,429	103,806	52,886	33,757	50	26,400	11,134

* After adjusting for opening and closing stock. 1952 - Cr. £20,851; 1951 - Cr. £3,991; 1950 - Cr. £313.
† Issued capital at December 31 1952 - 960,000 1s. shares or £48,000; 1951 - 960,000 2s. shares or £96,000; 1950 - 480,000 2s. shares or £480,000.

In spite of the fall in the average price of tin, the outlook for 1953 is good. During 1952 the company's operations were hampered by the fact that its mechanical excavator could not be used for the greater part of the year. However, it resumed operations during the latter half of the year and completed the stripping of overburden from the deposit on which it had previously been employed. A start was made in recovering the tin-bearing wash and an output of approximately 28 tons was recovered. The excavator was then moved and started to strip the hard laterite capping of another section of the hill, beneath which lies about 150 ft. of volcanic overburden before the tin-bearing wash is reached.

The company's ore reserve position is good and existing reserves, even at an annual production rate of 360 tons, are sufficient for approximately three years.

Production in 1953 was 327 tons of concentrates, but the heavy fall in the price of tin metal will no doubt be reflected in the financial results of the year.

In respect of 1953 the company has declared an interim dividend of 16¾ per cent, which compares with the corresponding payment of 25 per cent in the preceding year.

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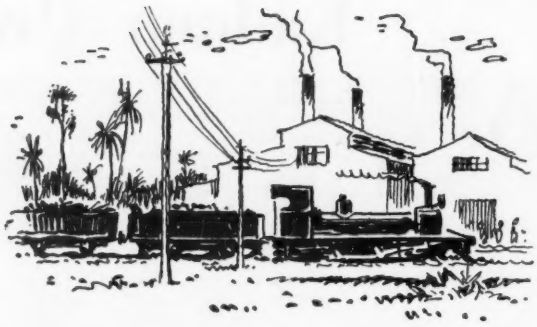

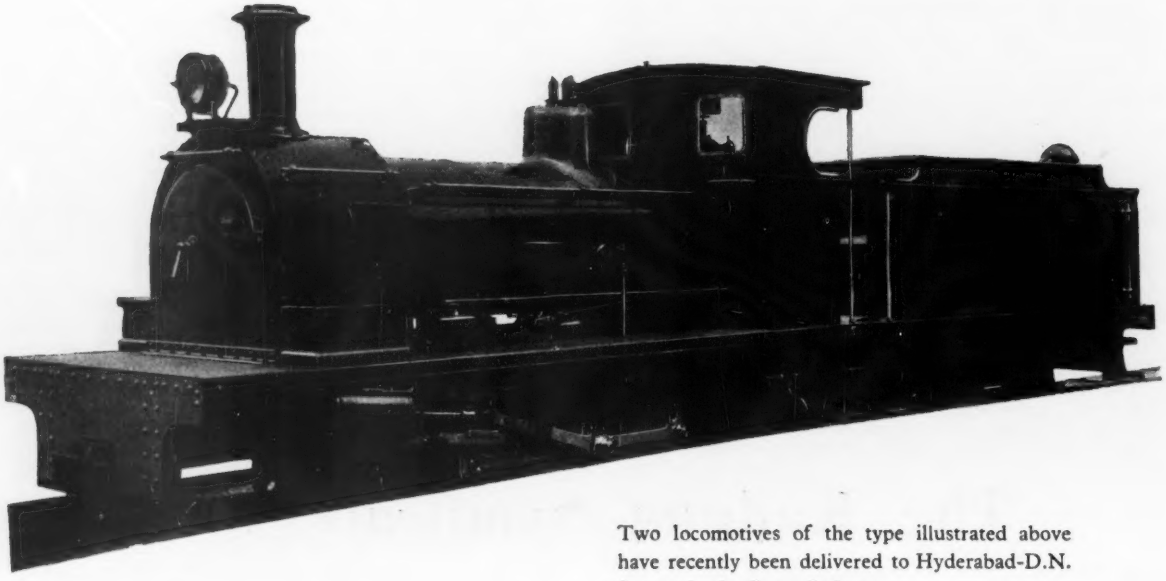

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British Guiana Consolidated Goldfields Ltd.

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THE Company, which is incorporated as a Public Company, has an issued capital of £294,628 in 2s. shares which are quoted on the London Stock Exchange. It has been dredging for alluvial gold in rivers in the interior of British Guiana for the past 17 years. Its active dredging plant consists of:

(a) A 6 cu. ft. Yuba dredge operating on the Potaro river areas which have an estimated life of a further 12 years in ground valued on average at 4 grains per cu. yd.

(b) A 5 cu. ft. Lobnitz dredge now approaching the end of its working life, operating on the Mahdia river. These dredges are electrically driven from land power stations, operated by an Atlas Polar diesel oil installation and Crossley-Premier engines driven by gas producers using wood fuel.

The Company has at present under construction a 10½ cu. ft. dredge to operate in the Konawaruk river area, where it is estimated there are over 30,000,000 cu. yd. of dredgeable ground averaging 3 grains per cu. yd. This dredge will not be in operation for at least another year.

The Potaro and Konawaruk plant are being financed by loans from the Colonial Development Corporation.

Investigations during the latter half of 1952 and early 1953 resulted in a decision to install hydro-electric plant at Tumatumari Falls on the Potaro river to provide power not only for the dredge now being erected on the Konawaruk river, but also for the Potaro dredge. For this purpose a subsidiary company is being incorporated in British Guiana to carry out the scheme, and the necessary plant required is now being manufactured in the United Kingdom. Good progress is being made with this installation and it is expected that, given a reasonable period of dry weather in the Colony, it will be completed next year.

It is confidently anticipated, therefore, that by the end of 1955, if not earlier, by which time the Mahdia dredge may have ceased operations, the Company will have in operation two dredges well equipped to handle the deposits which exist in the Potaro and Konawaruk areas.

The Company has been fortunate in obtaining from the Colonial Development Corporation the necessary finance to enable its subsidiary company to initiate what will be the first hydro-electric scheme ever to be carried out in British Guiana, a Colony with substantial water power potentialities.

RESULTS FOR 1953

The results for 1953 have been disappointing mainly due to the Potaro dredge, which is the Company's main gold producer, having to work through lower grade ground, the average grains obtained per cu. yd. from the two dredges being 3.32 grains fine compared with 5.27 in 1952. Although the yardage dredged increased by nearly 40 per cent compared with the previous year, the revenue earned owing to the lower grade of ground worked was £197,190, i.e. £40,000 lower than the previous year, whereas the operating expenses, largely owing to increased yardage worked, rose by £14,000 with the result that the operating profit was £50,000 lower than the previous year.

After providing for taxation and bringing in the carry forward from last year, including tax provided of £13,000 no longer required, and after writing off interest charges for loan monies supplied on development of the Konawaruk area and cost of changeover of projected method of power generation, a balance of £12,247 has been carried forward, the directors having recommended that no dividend be paid for 1953.

The Potaro dredge has now reached higher grade ground, and for the three months ended March 31, 1954, the combined yardage from the two dredges totalled 544,438 cu. yd. yielding 5,422 f.oz. of gold.

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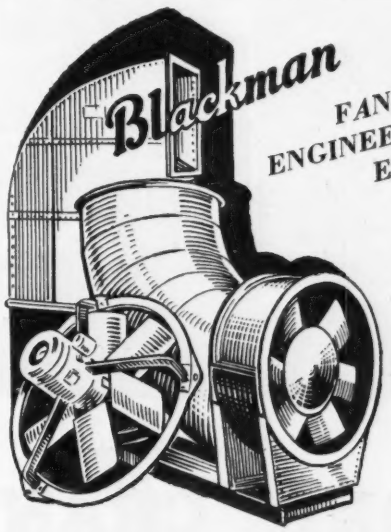

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Anglo-Iranian Oil Company

IT was in 1901 that Mr. D'Arcy, an Englishman who had made a large fortune goldmining in Australia, on his return to London became interested in reports of the oil possibilities of Persia. He sent a representative to Tehran who obtained from the Persian Government a concession to search for and develop the country's oil resources. His prospectors spent several years in hazardous and costly exploration; D'Arcy himself never visited Persia, though by the time of his death in 1917 he was able to see his venture fully established and his initiative rewarded.

By the time the oil was eventually found in 1908 the cost had proved too much even for D'Arcy's big fortune and the Burmah Oil Company had taken over the main burden of the enterprise. It was the first oil to be discovered in the Middle East, now one of the richest producing areas in the world, and the Anglo-Persian Oil Company (the name was changed to Anglo-Iranian Oil Company in 1935) with D'Arcy as one of its directors, was formed in 1909 to develop the oil resources of Persia. Since then the Company's ramifications have spread world-wide, though its main crude oil resources are still in the prolific oil territories of the Middle East, of which it was the original pioneer.

Abadan Refinery was commissioned in 1912 and in 1914 the British Admiralty entered into a contract with the Company for fuel oil for the Royal Navy. At the same time the British Government invested £2,000,000 in the undertaking. To-day, the British Government holds slightly over 50 per cent of the ordinary stock and nominates two directors to the Board. These directors are not, however, concerned with the normal commercial operation of the Company.

The second world war struck the Company in every branch of its spreading organization, its biggest war losses being in shipping. Its subsidiary, the British Tanker Company, lost about half of the 93 ships with which it began the war.

In 1946 an expansion scheme was started in all branches and, notwithstanding many difficulties, the Company and its assets grew yearly. By 1951 the Company's refinery at Abadan was capable of processing 25,000,000 tons of crude oil a year. The tanker fleet soon more than replaced its war-time losses and by 1952 about 150 ocean-going tankers were afloat under the B.T.C. flag with as many more on charter.

The events which led up to the standstill of the Company's Persian operations in the autumn of 1951 are too well-known to need detailing. A mission representing the world's leading oil companies left London on April 10 to conduct negotiations for a settlement of the dispute.

PRODUCTION AND EXPLORATION

Practically the whole of Anglo-Iranian's supplies of crude oil during 1953 came from its joint and other interests in Kuwait, Iraq and Qatar, the Company's off-take from these three countries totalling over 30,000,000 tons, compared with 16,600,000 tons in 1951.

Anglo-Iranian is the only producer of natural petroleum within the United Kingdom and last year its Nottinghamshire and Lancashire oilfields yielded nearly 55,000 tons. In Scotland the Company's subsidiary, Scottish Oils Limited, controls the shale oil industry which yields each year about 100,000 tons of crude oil. All the oil thus produced in Britain is refined at Pumpherston Refinery in Scotland where, apart from the normal range of petroleum products, detergents for domestic and industrial use are also made.

The oil industry depends for its existence on the discovery of new oilfields and through its prospecting subsidiary, the oil in many parts of the world, including Papua, Nigeria, Tanganyika, Zanzibar, West Indies, Sicily and an off-shore area in the Persian Gulf. In some areas the Company itself holds concessions and in others it is in partnership. On behalf of the Gas Council the Company is surveying and, in chosen places, test drilling for reservoirs of natural gas in England and Scotland. The search for new oilfields in England is also continuing.

REFINING

By next year, after the completion of two refineries now under construction, and of extensions to existing installations, the total refining capacity available to the world-wide Anglo-Iranian Group will be about 30,000,000 tons a year.

Refining capacity in the U.K. has been considerably increased in the past four years as a result of the expansion of the Company's existing refineries at Llandarcy and Grangemouth and the building of a new refinery on the Isle of Grain in Kent. The Company's refineries in Britain can now process 10,800,000 tons a year, more than any other refining group.

For the production of the Company's high grade BP Super motor spirit, catalytic cracking units have been installed at the three major refineries. They together process about 1,500,000 tons of semi-refined heavy oil a year and represent a capital outlay of £10,000,000.

On the Continent Anglo-Iranian has undertaken considerable refining expansion, both alone and in co-operation with other companies.

In France the Company's associate, Societe Generale des Huiles de Petrole BP, operates two refineries, one at Lavera, near Marseilles, the other at Dunkirk. Lavera Refinery can now handle 2,000,000 tons a year. Dunkirk refinery has a similar capacity.

In 1948 Anglo-Iranian acquired and rebuilt the Eurotank Refinery at Hamburg, Germany, which had been destroyed during the war. It is now processing about 700,000 tons a year. The Company also has a majority holding in another refinery in Hamburg—the Oelwerke Julius Schindler Refinery, which processes about 190,000 tons of oil a year. In conjunction with this refinery a lubricating oil plant is operated at Peine, near Hanover.

A new refinery at Antwerp, jointly owned by Anglo-Iranian and the Belgian company, Petrofina, was opened in 1952 and now processes nearly 2,000,000 tons a year.

Since 1948 Anglo-Iranian has owned the Porto Marghera Refinery, near Venice, jointly with Azienda Generale Italia Petroli and the refining capacity has been increased from 500,000 tons to 1,400,000 tons a year.

Two new refineries are being built by Anglo-Iranian, one in Australia, the other at Aden. Both will be operating by 1955. The Aden Refinery will have a capacity of 5,000,000 tons a year and 3,000,000 tons a year will be treated at Kwinana Refinery, Western Australia. The Company also owns, through The Commonwealth Oil Refineries Ltd., a smaller plant at Laverton, near Melbourne.

Jointly with the Shell Group, Anglo-Iranian owns a 4,000,000 tons a year capacity refinery at Haifa. At the moment, however, it is only being operated at 800,000 tons.

DISTRIBUTION AND TRANSPORT

Anglo-Iranian's shipping organization, the British Tanker Company, operates one of the largest privately-owned tanker fleets in the world of nearly 150 ships with a deadweight tonnage of about 2,000,000 tons. In addition an equal tonnage is on time and voyage charter. New tankers, including eleven 32,000 ton ships, are still being built for B.T.C.

Under the trade mark of the BP shield, Anglo-Iranian's products are marketed in many parts of the world. In the United Kingdom and Ireland the Company markets its main products jointly with the Shell Group through Shell-Mex and B.P. Ltd.

The BP International Bunkering Service is represented at some 150 ports on world shipping routes.

Recent years have seen a big expansion in the United Kingdom petroleum chemicals industry and in 1947 British Petroleum Chemicals Ltd. was jointly formed by Anglo-Iranian and The Distillers Company Ltd. for the production of petroleum chemicals. The plant is situated at Grangemouth in Scotland, feedstocks being supplied from Anglo-Iranian's refinery there. Nearby a second plant has been erected by Forth Chemicals Ltd., manufacturers of monomeric styrene used extensively in the plastics industry. British Petroleum Chemicals jointly owns this company with Monsanto Chemicals Ltd.

Only by constant research can an oil company keep in the van of modern requirements in exploration, production, refining and distribution, and for this purpose Anglo-Iranian operates two research establishments in Great Britain, one at Sunbury, near London, the other at Kirklington in Nottinghamshire. Here in the laboratories new processes and methods connected with all phases of the oil industry are constantly being evolved.

Boulder Perseverance Ltd.

BOULDER PERSEVERANCE LTD. was registered in 1923 as a reconstruction of the Great Boulder Perseverance Gold Mining Co. Ltd. It owns and operates the Perseverance gold mining lease of 24 acres at Kalgoorlie, Western Australia, which has proved to be one of the richest gold-bearing areas of its size in the world. The present company has always followed a policy of modernization and scientific development of the mine and treatment methods; whenever possible, a considerable portion of the profits has been ploughed back. The company owns 67.7 per cent of the capital of the Kargurli Ore Treatment Co. Ltd., a non-profit earning co-operative treatment plant with a capacity of approximately 1,000 l.tons per 24 hours. It also owns 65.2 per cent of the issued share capital of the Australian registered company, Kalgoorlie Enterprise Mines Ltd., which operates the Enterprise leases close to the Perseverance Mine.

Year to Mar. 31	*Treated (tons)*	*Grade (dwt.)*	*Cost* per s.ton* s. d.	*Bullion Revenue* £	*Ore Reserves tons*	*Grade (dwt.)*
1953	134,737	4.989	46 8	411,032	337,000	4.9
1952	132,387	4.95	46 7	397,844	334,550	4.9

* Including Treatment Costs.

Due entirely to increased efficiency achieved by the application of the most up-to-date methods, the total working costs (including treatment) per l.ton during the year ended March 31, 1953, increased by only 2d. to 65s. 4d. Australian currency, equivalent to 46s. 8d. sterling currency per s.ton. At A40s. 8d. the total mining cost for the year actually showed a reduction of A1s. 11d. per ton from the previous year, in spite of rising costs in all directions. The technical advances made by the company were also reflected by a substantial increase in mine development and exploratory work, which totalled 4,187 ft. against 3,001 ft. in the previous year.

In view of the satisfactory results of development and exploration, active steps will be taken to develop and mine ore which diamond drilling has shown to exist below the 2,220 ft. level, which is at present the bottom level of the mine. There are indications of ore at greater depths, but in the present unsatisfactory conditions for gold mining it is necessary to proceed with caution.

The effects of technical advances are very clearly reflected in the financial results during the year under review.

Year to Mar. 31	*Gross Revenue* £	*Mine Costs* £	*Taxation* £	*Net Profit* £	*Dividend* %	*Carry Forward* £
1953	413,184	343,333	26,620	18,118	10	7,531
1952	399,432	337,085	24,324	13,793	7½	6,778

In view of the uncertain economic outlook for the gold mining industry, £5,000 was transferred to general reserve, which now stands at £51,154.

The Kalgurli Ore Treatment Co. also operated at a high level of efficiency throughout the year. Despite a reduction of 2¼ days in milling time, due to extra holidays and other causes, the throughput amounted to 342,082 l.tons, which was only 44 tons lower than the quantity treated in the previous year. The extraction rate calculated from Mint returns was 93.4 per cent of the assayed head value. Despite the utmost efforts in economy of power, wages and stores, costs rose over the year by A2s. 1d. to A24s. 8d. per ton, this increase more than wiping out the economies made in mining cost.

Kalgoorlie Enterprise again applied the whole of its working profits to development of the mine. A satisfactory feature of the year's operations was a further increase in the tonnage hoisted and treated to 61,960 l.tons (56,644), while the average value improved from 6,194 dwt. to 6,367. The outlook is reported to be definitely brighter than for some years.

In his statement accompanying this year's report and accounts, Dr. K. B. Edwards, chairman of Boulder Perseverance, pointed out that, in accordance with what used to be sound financial practice, the mine lease, properties and plant of Boulder Perseverance had been written down over the years to extremely low figures, which in no way represent even the break-up value of the company's assets.

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North Kalgurli (1912) Ltd.

ONE of the most outstanding events in the recent history of North Kalgurli (1912) was the commissioning of its new shaft on August 4, 1952. This event was a landmark in the company's affairs for several reasons. It is in the approximate centre of gravity of its ore reserves, estimated to be about 2,000,000 tons; it takes care of the hoisting duty and most of the service requirements of the southern group of leases; it allows for more economical mining; and, most important of all, it has enabled the company to plan for the first time an overall development programme for the opening up of its southern group of leases.

Seen against a wider background the new shaft, which has been sunk to a depth of 1,632 ft. or 20 ft. below level 14, is the largest on the Golden Mile and, providing as it does an increase in the company's hoisting capacity from its present level of 18,000-20,000 tons per month to as much as 30,000 tons per month, it has placed North Kalgurli in the position of being one of the Big Three producers in this famous goldfield.

In some ways it is a pity that the latest report and accounts available only cover operations for the year ended December 30, 1952, that is, a period of six months during which the new shaft has been in operation. But even so, the favourable results achieved in that time in several directions give a good idea of the benefits to be expected when operations have been fully orientated to derive the maximum efficiency from the new shaft. For example, two months after the commissioning of the shaft, a savings of over 4s. per ton milled was attained and this rate of savings was maintained until the end of the year.

This significant decrease in costs reflected the improved working conditions in the mine which allowed for the greater utilization of mechanical equipment, particularly locomotive haulage, and better service supply and ventilation. But perhaps the best indication of what the new shaft has meant in terms of costs was given by Mr. C. T. Ley at the last annual meeting when he said that while wage rates rose during 1952 by approximately 13 per cent and the cost of materials by 7½ per cent, the overall increase in the mine's working costs expanded by only 10.6 per cent. Nor have the economies effected proved to be transitory. During the first five months of 1953 there was a considerable reduction in costs compared with the corresponding period of the year under review. Looking further ahead along these lines it was announced in the company's progress report covering the period September 9 to December 30, 1953, that the new electric winder at the Kalgurli shaft had replaced the old steam winder and was servicing that section of the mine. Quite apart from the positive advantages accruing from this installation, it is anticipated that the savings in running costs may be as much as £400 per month.

Be all that as it may, the chief interest in the new shaft stems from the advantages expected to flow from the development programme designed to open up the southern leases at depth—although in this context it should be mentioned that the new shaft provides facilities for lower level development in the northern portion of the mine, work on which has been suspended for several years.

DEVELOPMENT OPERATIONS

Naturally, development operations were restricted during the first seven months of 1952 while the new shaft was being completed but in the latter half of the year some notable results were recorded. On level 10 in the North Kalgurli section driving on the East Lodes exposed a run of 106 ft. assaying 15.6 dwt. per ton over a width of 7 ft. and subsequent developments on and winzing from this level carried out during 1953 also produced good results; in particular, a drive south for 30 ft. yielded average assay values of 14.5 dwt. per ton over a width of 5 ft. On the important level 5, a drive, begun almost due north of the Kalgurli shaft but inside the North Kalgurli lease section in a westerly direction, advanced 45 ft. averaging 7.2 dwt. per ton over 5 ft. However, driving on this level in the Birthday South lease area, Kalgurli section, gave values from 3.2 dwt. to 10.5 dwt. per ton over an average width of 5 ft. for a length of 264 ft. During the last quarter of 1953 winzing on this level from both the East Branch Lode and from the Flat Lode, in the North Kalgurli section, yielded above average values.

No development work was carried out at depth during 1952. But during 1953 development work was carried out on level 17 in the Kalgurli section at the bottom levels of the Birthday South lease area and two drives gave excellent gold values. One drive to the south-west on the East Lodes advanced 33 ft. averaging 11.2 dwt. per ton over a width of 15 ft., equivalent to 2,016 in. dwt.; the other, a parallel drive to the north-west, gave values of 12.6 dwt. per ton over a length of 12 ft. By way of contrast shallow level work in the last quarter of 1953 was also carried out on the Kemlo Lode, No. 2 level, and in a winze 58 ft. of the 88 ft. sunk disclosed assay values averaging 15.4 dwt. per ton.

Diamond drilling operations over the past two years have been chiefly concerned with locating the downward extensions to the known orebodies and some excellent cores have been obtained. On level 14 in the Birthday South lease area during 1952, a hole intersected 60 in. of ore assaying 10.5 dwt.; 30 in. assaying 9.5 dwt.; 114 in. assaying 8.9 dwt.; and 30 in. assaying 5.5 dwt. In the North Kalgurli section a hole on level 6 intersected 18 in. of ore assaying 347 dwt. while in the last quarter of 1953 another hole intersected 60 in. of ore assaying 14.5 dwt.; 96 in. assaying 5.1 dwt.; 60 in. assaying 5.0 dwt.; and 12 in. assaying 11.5 dwt. But probably the most gratifying result obtained was in 1952 when a hole, bored on the projected position of the North Kalgurli East Lodes on level 9, intersected 120 in. of ore assaying 15.2 dwt.; 60 in. assaying 12.2 dwt.; 252 in. assaying 4.0 dwt.; and 72 in. assaying 6.2 dwt.

In more general terms, the diamond drilling programme carried out over the last two years has indicated the northern extensions of the Union Jack Lode, the West Branch Lode, the Main West Lode and its faulted continuation; the southern extension of the East Branch Lode; the upward extension of the East Branch of "A" Lode; and the downward continuation of both the Main West Lode ore channel and the Iron Duke South Lode.

RESULTS FOR 1952

The feature of operations in 1952 was the higher average grade of ore sent to the mill which more than offset the smaller tonnage crushed and gold production increased by 7,207 f.oz.

Year	*Milled (tons)*	*Grade (dwt.)*	*Yield (oz.)*	*Developed (footage)*	*Ore Reserves* (tons)*	*(dwt.)*
1952	238,165	5.5	66,135	9,799	2,234,415	5.57
1951	251,743	5.0	58,928	8,206	2,183,162	5.62
1950	244,066	5.2	59,063	8,588	2,314,941	5.53

* Figures given relate to average of positive and probable tonnage and their estimated values per ton.

The higher gold output redounded to the advantage of the profit and loss account, the salient features of which are set out in the table below.

Year	*Ore Proceeds* £	*Mining Costs* £	*Taxation* £	*Net Profit* £	*Dividend* %	*Carry Forward* £
1952	796,586	662,568	60,526	45,479	87½*	43,177
1951	739,799	625,923	48,882	46,707	62½	50,737
1950	734,035	519,026	113,200	89,081	100	42,403

* Based on £110,000 issued capital.

A point not brought out in the above table was that the sum of £96,064 previously provided for taxation and now no longer required was allocated to reserve against advance development account. The dividends declared in respect of the year under review comprised an interim payment of 6d. per 2s. share on an issued capital of £110,000 and a final payment of 7½d. per 2s. share on an issued capital increased to £220,000 by the one-for-one bonus issue to shareholders in August, 1953. Based on the doubled capital the percentage distribution would be 43¾ per cent.

Results for 1953 should be at least as good as those attained during the year under review. Provisional figures reveal that the tonnage treated rose to 264,200 tons from which 60,929 oz. were recovered, although this latter figure may well prove to be higher. The chief difficulty is to try to assess how far and to what extent the higher costs of labour and materials will offset the reduction in working costs and the additional revenue received from premium gold sales. Although the premium revenue was dwindling throughout the whole year and finally ran off altogether, the company has £25,000 in hand in respect of gold sales made in 1952. In any event, shareholders should not suffer now that the long term future of the mine is assured. Whether or not this assessment is correct the company has already declared an interim payment of 12½ per cent on its doubled capital which is the equivalent of the corresponding payment of 25 per cent on an issued capital of only £110,000 made during the year under review.

Tronoh-Malayan Tin Group

AS a result of the energetic measures taken by General Sir Gerald Templer while High Commissioner of Malaya, the bandit problem in that country has become somewhat less pressing than it once was. The problem has not by any means disappeared entirely, however, and the position must be watched to see that the attacks do not flare up again. But subject to certain precautions being taken, prospecting can be undertaken in some areas.

Meanwhile, the Tronoh-Malayan Tin Group has been casting its net over an area wider than the Federation; it set up Tromal Prospecting Ltd., to carry out prospecting on the sea-bed off the coast of Siam, near Bhuketand. The company has applied for a lease covering a selected area. Kramat Pulai, another company in the Tronoh-Malayan Tin Group, has received permission to prospect the sea-bed off the coast of Malacca. Chinese operators have been working the Malacca coast for some years and this has indicated the possibility of finding values in the sea-bed.

TRONOH MINES LTD.

The bulk of Tronoh Mines' revenue is derived from the operation of its four dredges, but it has a wide spread of interests beyond its own dredges. It operates Tin Lay Ltd., in Siam, a wholly-owned subsidiary, and holds large interests in three other tin producers in the Tronoh-Malayan Tin Group including, Sungei Way Dredging, Sungei Besi Mines and Ayer Hitam Tin Dredging; it has a stake in Harrietville (Tronoh), the Australian gold dredging company; in its investment portfolio at December 31, 1952, stand British Government securities to the book value of £51,085, and it has an interest in the prospecting company, Tromal Prospecting Ltd.

While two of the company's dredges were out of action for part of the year to December 31, 1952, output of tin concentrates rose by 253 tons to 1,713 tons. But the price received contracted from £650 per ton to £587 and the costs of mining rose from 14.8d. per cu. yd. to 15.6d. Net profits were slightly higher at £303,718, enabling the payment of dividends amounting to 6s. 6d. per share on the issued capital.

The balance sheet reflects a heavy expenditure on plant, including the bulk of the cost of replating the pontoons of two of the dredges during the year. During 1952, Tin Lay was able to repay some of the advances outstanding at the end of 1951, leaving a balance of £69,382. The market value of quoted investments continues to show a substantial capital appreciation over the book value. At the end of 1952, the increase in value was of the order of 75 per cent. Net current assets stood at over £1,000,000, and this is an acknowledgment of the financial strength of Tronoh.

During 1953, Tronoh Mines effected a further improvement in output, production reaching 1,981 tons tin ore against 1,712 tons tin ore in 1952, but the metal realizing only three-quarters of the 1952 price, the first four interim dividends have been reduced to 80 per cent, as compared with 95 per cent for the corresponding dividends of 1952. The first interim dividend for 1954 amounted to 15 per cent against 20 per cent for the first dividend of 1953.

In the first three months of 1954 output increased by 206 tons to 635¾ tons tin ore; this rise, combined with the better tin price, gives hopes of more favourable times.

SOUTHERN TRONOH TIN DREDGING LTD.

Three factors combined in the year to December 31, 1952, to make the financial results of Southern Tronoh disappointing. First, although the amount of ground treated was insignificantly lower, the output of tin concentrates fell sharply from 777 tons to 635 tons because the average value of the ground was much poorer. Second, the reaction in the price of the metal following the Korean boom depressed the average price received for tin concentrates by £64 per ton, and third, mining costs rose by 23 per cent to £207,523. The tax authorities, it is true, felt a good deal of the troubles caused by this squeeze—their share of taxable profits was £105,617 against £216,230—but net profits were little under one-half those of the previous year. Accordingly, the dividends paid out were halved at 2s. 6d. per share.

During 1953, the company hit a patch of even greater adversity; earlier on it had been recognized that No. 1 dredge would be out of commission in order that the drive could be converted to electricity, an action required to combat the difficulties of shortage of labour and fuel. The time allowed for this work was six months, but in the event nine months elapsed because it was discovered that the pontoon needed replating. Thus, for the greater part of the year, Southern Tronoh was relying on one dredge instead of two. This dredge worked an area which bores had indicated would have good values, but the presence of clay of an abnormally tenacious nature, which would not break up in the screen, led to a fall in the recovery of tin. An experiment was made with a high-speed puddler, but this did not solve the difficulty. As a result of all these troubles, the output of Southern Tronoh in 1953 fell from 635 tons to 189 tons tin ore.

With both dredges working again, and the No. 2 dredge turned to a northerly direction in the hope that clay will no longer cause trouble, the year 1954 should give better results than in 1953. In the first three months of the current year, the output of tin concentrates, amounting to 207¼ tons, was greater than in the whole of the previous year. Shareholders will be encouraged by this turn of events and the higher price of tin into hoping for an early resumption of dividends.

MALAYAN TIN DREDGING

In the year to June 30, 1953, Malayan Tin Dredging continued to gain very substantial advantages from the programme of reorganizing its four dredges. In 1950-51 tin ore recovery amounted to only 319 tons; in the following year it multiplied itself to 1,141 tons but this huge expansion did not exhaust the company's possibilities, for in 1952-53, output increased by over 60 per cent to 1,856 tons. The price of the metal during the latest year was slightly lower than in the previous year, but the drop was so slight that tin revenue expanded from £645,505 to £1,019,312. Tribute revenue, too, was buoyant and interest and dividends reflected the better conditions experienced by the tin industry in the previous financial year. Even more extraordinary than any of these events was the course of mining costs; the extra tonnage was produced with an increase of roughly £50,000 to £364,639. Other charges either fell or if they rose, they did so only to a minor degree; the most important movement on this side of the profit and loss account was the diminution in the interest on advances, a reflection of the repayment of the loan from Southern Malayan Tin Dredging out of the proceeds of a new issue which increased issued capital from £200,000 to £300,000. The effect of this long series of favourable forces was to almost treble the previous year's enhanced gross profits.

But there the happy story is brought to a standstill. Out of the increase of £418,182 in gross profits, tax took no less than £333,463, the reason for this apparently huge percentage of additional profits being absorbed by tax is that tax losses of previous years and the big capital expenditure allowances had been used up, and that profits would have had to bear a much heavier burden even if profits had not risen so greatly. In a way, the company was a trifle unfortunate that its allowances were used up quite so quickly for EPL alone took £49,200 in 1952-53; a little later much of that might have been avoided. The board decided that a larger part of the improved profits should be distributed, shareholders receiving 6s. per share.

Output of tin concentrates in the first six months of the current year was 1,201 tons against 1,042 tons. The first two interims for 1953-54 amount to 40 per cent against 60 per cent for the corresponding dividends of 1952-53.

SOUTHERN MALAYAN TIN DREDGING LTD.

In recent years, Southern Malayan Tin Dredging has been increasing its mining lease areas, but in the year to June 30, 1953, that trend was reversed by the non-renewal of leases over 194 acres at a time when only 39 acres at Chenderiang were added. The company now leases 5,721 acres but it also holds prospecting permits over two adjoining areas of State land totalling 400 acres. It is hoped to bore these areas in 1954. Of the land leased, 2,644 acres have been dredged, and this figure includes the 221 acres worked by the Japanese.

All six dredges owned by Southern Malayan operated the whole year, and consequently the amount of ground treated improved, but as the average value of the land was lower, the amount of tin concentrates produced did not expand to the same degree, though it was higher at 3,216 tons against 3,116 tons. The benefits which should flow from an expansion of this sort were lost through a somewhat lower metal price and by bigger mining costs. The balance between sundry

revenue and sundry expenditure moved against the company, and gross profits were roughly £16,000 down. Tax before allowing for over-provisions was less onerous in the latest year. A change in the 1953 Finance Act gave relief to mining companies which had increased output above the standard years; this amendment and a reduction in the standard rate of income tax enabled £51,475 to be written back. Dividends once again totalled 6s. per share. The first two interims for 1953-54 amount to 40 per cent against 60 per cent for the corresponding dividends of 1952-53.

The balance sheet at June 30, 1953, indicates great strength, the result of years of ploughing back profits while paying shareholders a not unsatisfactory return on their money. As a consequence of current assets jumping up from £2,376,539 to £2,725,879 and current liabilities contracting from £979,617 to £643,016, net current assets have risen from £1,396,922 to £2,082,863, and at that figure are equal to 24s. per 5s. share on the £432,500 issued capital.

AYER HITAM TIN DREDGING LTD.

During the year to June 30, 1953, Ayer Hitam Tin Dredging, whose mining leases cover 1,930 acres in the Ulu Langat district of Selangor, Malaya, dredged 21 acres (against 16 acres in the previous year) bringing the total average worked out to 187 acres. As a consequence of working this larger area, the dredge, which incidentally works to a depth of 120 ft., treated the much larger quantity of 2,781,007 cu. yds. A sharp decline in the average value, however, reduced the output of tin concentrates from 1,769 tons to 1,276 tons. During the year the total cost of mining kept remarkably steady, and a higher income upon interests and dividends was enjoyed. After allowing for the tax authorities' share of the smaller earnings, net profits amounted to £263,212 as compared with £349,697.

In the Korean boom, the board followed a comparatively conservative dividend policy and the cut in profits did not bring lower distributions to shareholders. In fact, the smaller earnings of 1952-53 were still sufficient to pay dividends totalling 110 per cent and to retain in the business a sum slightly bigger than the cost of the dividends.

In the current year, the dredge has lost rather more than two months' operating time, part of the loss being attributable to a major overhaul, and part to failure of the ladder hoist gear. Despite this set-back, output in the first nine months of the current year was a little higher at 857¼ tons as compared with 815 tons tin ore in the corresponding period of 1952-53.

The first two interim dividends for 1953-54 total 40 per cent as compared with 50 per cent for the corresponding dividends of 1952-53.

SUNGEI BESI MINES LTD.

Mining operations of Sungei Besi Mines are of two different types: the first is the working by open-cast method of 400 acres under mining lease near Sungei Besi, Selangor, Malaya; the second is the operation of a dredge at Kota Tinggi, Johore, over an area of 1,084 acres, known as the Pelepah section.

During the year to March 31, 1953, the last of the slime which filled the excavations made by the Japanese during the occupation of Malaya in the floor of the North open-cast of the Sungei Besi section was removed, but pockets of slime were still being discovered in the South open-cast. Heavy rainfall caused subsidence of the western slopes of the North open-cast and difficulties were encountered by hard rock intrusions at depth. Since the end of 1952-53, a conveyor belt has been installed after delays in obtaining delivery, and this is working well now that teething troubles caused by the heavy clay building up have been cured.

The dredge at the Pelepah section was compelled to close twice during 1952-53; once for the annual overhaul and once because the top tumbler broke where the Japanese had welded it. Despite this additional hold-up, and the consequent fall in the amount of ground treated, tin ore output rose from 624 tons to 648 tons because the grade of the ground at 0.71 lb. per cu. yd. was 0.13 lb. higher than in 1951-52. Over a period, the river Sungei Pelepah has been diverted from its course so that the old river area can be worked. The second deviation was completed in December, 1952, and a further useful area of limited size will be gained when a road is diverted.

Net profits for 1952-53 were slightly below the level of the previous £131,242 against £135,497, but the distribution to shareholders was cut from 3s. 7.2d. per share to 2s. 9.6d. per share.

During the year to March 31, 1954, output of tin ore totalled 1,016 tons.

Three interim dividends, totalling 30 per cent, have been paid on account of 1953-54; the corresponding dividends of 1952-53 amounted to 50 per cent.

SUNGEI WAY DREDGING LTD.

When Sungei Way Dredging's three dredges move in the near future into higher grade ground, the company will have at last left behind the main troubles caused by the Japanese occupation.

Tin ore production during the year to June 30, 1953, was slightly more than double that of the previous year, largely because only one dredge was working for the greater part of the year. Similarly, output in 1952-53 was below full capacity, because the third dredge recommenced as the financial year was ending. When the three dredges are in full production and working ground of average value they should be producing at an annual rate of 1,600 tons tin ore, as compared with 782 tons tin ore in 1952-53. When that stage is reached, the 1,277 acres of tin-bearing land at Sungei Way, Malaya, held by the company, is expected to last for about 15 years.

During 1952-53, the liquid resources of the company have been severely strained by heavy capital expenditure, and the banks have been affording temporary loans. This accommodation is being repaid out of the proceeds of a new issue whereby shareholders were entitled to apply for one new share of $1 (2s. 4d.) for every three shares held, the price being $2.50 (5s. 10d.). The issue found favour with shareholders.

The distribution for 1952-53 was restored to 15 per cent (5 per cent interim and 10 per cent final) from the 10 per cent which was paid for 1951-52.

Prospects for the current financial year are somewhat brighter, the output for the first nine months of the year at 937 tons tin ore being an improvement of 424 tons and even better results are expected as the better grade ground is reached.

SUMMARY OF OUTPUT, PROFIT AND TAXATION

Name of Company	*Period Ending*	*Ground Treated (000 cu. yd.)*	*Tin Ore Recovery (tons)*	*INCOME*			*EXPENDITURE*		*Profit before Tax*	*Govt. Tin Royalty (see Ore Sales)*	*Taxation*	*Dividends*
				Ore Sales and stock (less Govt. Tin Royalty) £	*Tribute & Sundry Mine Revenue* £	*Interest Dividends etc.* £	*Mining Costs* £	*Head Office and other expenses* £	£	£	£	£
Malayan Tin Dredging Ltd.	30/6/53	9,211	1,856x	1,019,312	35,446	96,573	368,177	135,845	647,309	188,366	400,358	193,500
	30/6/52	8,970	1,141x	645,505	16,873	80,714	320,793	193,172	229,127	120,205	66,895	110,250
Southern Malayan Tin Dredging Ltd.	30/6/53	15,318	3,216x	1,664,094	32,976	41,951	525,771	28,768	1,184,482	304,937	663,664	278,963
	30/6/52	13,869	3,116x	1,598,229	27,271	64,256	459,114	30,094	1,200,548	292,477	752,195	272,475
Tronoh Mines Ltd.	31/12/52	6,528	1,713	1,003,606	79,420	130,588	464,516	24,025	725,073	180,602	421,293	205,875
	31/12/51	5,781	1,460	923,648	78,299	128,946	390,355	27,757	712,781	169,647	416,374	182,625
Southern Tronoh Tin Dredging Ltd.	31/12/52	3,222	635	372,649	12,885	17,773	209,835	33,919	159,553	71,312	105,617	52,500
	31/12/51	3,296	777	506,462	14,760	17,647	170,000	40,111	328,758	95,269	216,230	106,000
Ayer Hitam Tin Dredging Ltd.	30/6/53	2,781	1,276	682,940	2,386	25,483	160,026	17,532	533,251	107,560	270,039	106,650
	30/6/52	2,392	1,769	1,006,597	1,494	18,315	152,457	22,887	851,062	177,587	501,365	103,950
Sungei Besi Mines Ltd.	31/3/53	2,625	1,139	655,743	2,235	9,848	336,984	33,413	297,429	53,290	163,178	60,915
	31/3/52	2,844	1,078	624,453	2,758	8,782	261,462	18,207	356,324	114,448	218,966	77,267
Sungei Way Dredging Ltd.	30/6/53	3,414	783	422,984	7,779	7,087	272,551*	44,057	121,241	†	17,802	21,017
	30/6/52	1,812	385	222,991	6,409	7,021	128,004*	16,087	92,331	†	9,104	14,012

* Includes tribute payment of £11,241 in year to 30/6/52 and £23,973 in year to 30/6/53 x Includes recovery from dumps and tribute † Not available

Redruth-Malayan Tin Group

THANKS to the energetic measures enforced by General Sir Gerald Templer and carried on by his successor, the bandits in Malaya have been much less active than a couple of years ago. The regrouping of some of the mine buildings, expensive though it was in effort, money and time, has paid off quite well. But the men on the spot still have to endure the tension of watching in case activity should once more break out.

Financially, direct security measures have been costing less than in the more troublesome times, but the burden has not entirely disappeared, and expenditure in what would be called here in this country social services is high, a fact not generally recognized even by those who are not wilfully blind. The companies contribute each year to a provident fund for the Asian staff, and in addition provide them with pensions and medical services. These amenities have to be maintained even when conditions are unfavourable to profit-making, so that there is no chance of pushing the burden on to other shoulders when losses are being sustained. The provision of such services is additional to the excessive sums paid out as Government royalties and as income tax, either here or in Malaya.

In recent months the price of tin has been rising and there is once more an incentive to prospect for new areas to replace those being used up. The opportunities for prospecting are still limited by potential attacks by bandits, and even if new ground is located, the solution of the financial burdens will not be easy, especially since E.P.L. and other taxation skimmed off a great deal of the profits of the boom time. The question of prospecting is bound up with the proposed International Tin Agreement which would set up export quotas if an unfavourable estimate of future consumption and production were made. In spite of precautions taken to eradicate the worst features of export quotas, the system is a hindrance to prospecting and acts to the detriment of the big producers, carrying heavy overheads.

GOPENG CONSOLIDATED LTD.

Although Gopeng Consolidated's main interests are centred on tin-winning, it also has a stake in the rubber industry. Its main asset is the holding of 1,860 acres of tin-bearing land at Gopeng, Perak, Malaya, and it also owns the Moynalpy Rubber Estate which has 563 acres under rubber. Its other interests are held jointly with Kinta Tin Mines; these comprise a joint interest in 2,200 acres of tin-bearing land, and in Sanglop Rubber Estates Ltd. which has 825 acres under cultivation.

During the year to September 30, 1953, the price of tin continued to fall and ore sales realized only £486 per ton against £579 per ton. Superimposed on this adversity was a cutback in production from 857 tons to 585 tons following the reorganization of the Kampar water supply pipeline. Consequently, mining revenue was reduced from £622,049 to £371,211, but there was no corresponding relief by way of reduced mining costs. In point of fact, they rose by just over £4,000.

The rubber side of the business gave no support in these difficult conditions; the two estates made a total loss of £1,351, which fortunately was eliminated by the refund of replanting cess amounting to £1,775. As a result of the company's activities at a time when the prices of its products were low, the gross profit before writing off capital expenditure was £191,066 against £407,565. The reduction in tax liability was even more pronounced: instead of paying E.P.L. the company even had a refund of the levy amounting to £30,127 and the total tax bill came to £83,708 against £258,808. In the end, net profits contracted from £148,757 to £107,358. The smaller figure would have paid the 1951-52 dividends totalling 50 per cent but the margin left would have been very small. In accordance with the conservative policy of the group the distributions were cut to 32½ per cent.

The reduction in output is expected to be only temporary, first because moving equipment from one place to another prevents its economic use, and second because the deviation of the pipeline releases a block of good ground for profitable exploitation. During the current year, the change over to the Kampar Water Supply has been completed and output during the March, 1954, quarter rose to 145¼ tons as compared with 101¼ tons in the December quarter, but even this improved output is low in comparison with other recent quarters, and more good news can be expected as later production figures are issued. The production total for the current year is, however, hardly likely to recover from this slow start; the financial results will depend on the course of tin prices and as recent events have shown the course can move rapidly from one direction to another. The first interim dividend for 1953-54 reflects the less favourable conditions at the beginning of the financial year, being a payment of 5 per cent against 10 per cent for the corresponding dividend of the previous year.

RAMBUTAN LTD.

Although Rambutan enjoys a useful income from investments and bank deposits, the company chiefly depends, like the other companies in the Redruth-Malayan Tin group, on its mining revenue. In the year to June 30, 1953, out of a total revenue of £68,969 no less than £64,700 came from mining. On this occasion tribute contributed a larger amount than usual, £14,640, and apart from £395 sundry revenue, the remainder of the revenue came from the sales of tin ore produced by operations in two paddocks. During 1952-53, paddock "Y" yielded 63.5 tons of tin ore, while paddock "Z" produced only 16.72 tons. Conditions in paddock "Y" therefore govern to a large extent the year's physical results and hence have a powerful influence on the financial results.

The increase in tributes received during 1952-53, already mentioned, offset a small falling off in mining revenue, and the amount spent on mining was maintained virtually unchanged. This means that the cost reckoned on a cubic yard basis fell from 35.15d. to 30.77d.—no mean achievement. After the tax collector had taken his share, gross profits of £18,566 became net profits of £9,301, an improvement of £1,402 on the previous year. The board decided to reduce the payments to shareholders from 10 per cent to 8¼ per cent, presumably in order to strengthen the company's finances still further after allowing for a heavy capital expenditure incurred on the deviation of the Government road and the pipeline.

The first nine months of the current year have seen a satisfactory increase in the tonnages of tin ore produced from 61½ tons to 78¾ tons, and as the biggest portion of that increase took place in the March quarter further improvements can be expected during the last quarter of the financial year. As the price of tin was stronger during this period of expansion, the

SUMMARY OF OUTPUT, MINING PROFIT AND TAXATION

Name of Company	*Period*	*Ground Treated (000 cu. yd.)*	*Tin Ore Recovery (tons)*	*Ore Sales* £	*LESS* *Govt. Royalty* £	*Smelters' Charges* £	*Tribute on Ore sold* £	*Mining Expenditure* £	*PLUS* *Sundry Revenue from Tribute, etc.* £	*Mining Profit* £	*PLUS* *Sundry Revenue* £	*LESS* *Head Office and Other Expenses* £	*Profit Before Tax* £	*Tax* £	*Dividend* £
Gopeng Consol.	30/9/53	1,767	585	339,268	52,772	2,200	—	125,439	31,943	190,800	16,416	16,097	191,119	83,708	69,755
	30/9/52	1,968	857	591,433	92,367	3,079	—	127,120	30,616	399,483	25,238	16,393	408,328	258,808	103,889
Rambutan	30/6/53	302	80	49,665	7,902	300	33	38,660	15,035	17,805	4,269	3,282	18,792	9,265	4,688
	30/6/52	269	81	53,365	8,577	261	17	39,333	7,174	12,351	4,215	2,877	13,689	5,834	5,250
Tekka	31/3/53	482	109	72,449	11,685	437	1,066	34,130	3,235	28,366	9,518	2,690	35,194	19,089	9,636
	31/3/52	462	103	68,410	11,067	333	4,794	32,867	4,072	23,421	12,666	2,693	33,394	17,685	9,413
Tekka-Taiping	31/10/52	1,473	169	141,323	22,546	224	—	111,869	196	6,880	9,576	3,488	12,968	10,172	10,750
	31/10/51	1,928	215	221,414	34,967	175	—	83,336	496	103,432	10,660	8,316	105,776	65,822	21,249
Pengkalen	30/9/52	2,091	532	369,240	57,129	1,888	6,929	98,297	10,513	215,510	12,997	13,075	215,432	127,187	45,675
	30/9/51	1,923	555	436,100	67,289	1,579	8,971	84,272	15,201	289,190	12,229	15,545	285,874	161,418	46,250
Kent (F.M.S.)	31/12/52	1,531	478	330,980	51,577	1,833	4,317	95,396	668	178,525	4,319	11,279	171,565	110,911	38,587
	31/12/51	1,718	549	409,035	63,595	1,601	5,530	82,929	401	255,782	3,178	12,999	245,961	147,468	55,125

financial results for 1953-54 should show an improvement over the not unsatisfactory figures of the previous year.

TEKKA LTD.

During the year ended March 31, 1953, Tekka continued to work over its 956 acres of alluvial tin lands in the Kinta district of Perak, Malaya, using hydraulicing methods. Up to October, 1952, work had been proceeding in both the old and the new paddocks, but in that month the old paddock was finally abandoned and the plant transferred to the new. When this move was accomplished, two of the three elevators were working at the 68 ft. level and the third at 50 ft. Satisfactory outputs were obtained from the virgin ground lying beneath the overburden of tailings and slimes. The average recovery per cubic yard during 1952-53 remained unchanged at 0.51 lb., but the volume of ground treated showed an increase from 462,100 cu. yd. to 482,400 cu. yd. The resultant expansion in the amount of tin ore produced from 103.2 tons to 109.24, and a rise in the average price received from £506 to £542, pushed revenue up to £75,684.

A decrease in the tribute payable offset the swelling of other costs, and this would have made for much bigger profits but a drop in interest received kept down the increase of gross profits to £1,800. Dividends for the year were maintained at 5 per cent.

In the year to March 31, 1954, output expanded greatly; total production reaching 149½ tons against 109¼ tons.

TEKKA TAIPING LTD.

Three factors combined to drag down Tekka Taiping's earnings for the year to October 31, 1952. First, the average price of tin was much lower than a year earlier when the post-Korean boom reached its peak. Second, the only dredge left to the company, the other two having been dismantled during the Japanese occupation, was stopped for the last three months of the year in order to effect repairs and renewals. Third, the grade of ground treated was on the low side, that is to say, 0.25 lb. per cu. yd.

The decline in the tin price is reflected in the average price received for tin ore in 1951-52, that is to say, £564 per ton as compared with £633 in the previous year. The closing down of the dredge cut the volume of ground treated from 1,927,600 cu. yd. to 1,472,650 cu. yd., and the output of tin ore from 214.53 tons against 168.69 tons. Working costs, including security measures, jumped up from £77,359 to £107,449, and when this higher cost is related to the smaller tonnage, it is found that the cost of producing one ton of tin ore rose from £388 to £663. In other words, whereas tin was realizing a working profit of £245 per ton in 1950-51, it was causing a working loss of £99 per ton in 1951-52. In one way, the comparison is weighted against the later year for working costs included a gratuity, and the costs incurred in connection with the repairs and renewals to the dredge mentioned above.

The more adverse working conditions were reflected in the smaller dividends paid, whereas a total of 10 per cent was distributed in 1950-51, only 5 per cent was declared for 1951-52.

In the year to October 31, 1953, tin output was somewhat affected because the dredge was out of commission in the early part of the year, but of more importance was the lower price of tin. At one time during the year, operating and financial results were so disappointing that the chairman, who was visiting Malaya, went to the property and discussed with the general managers the question of a possible temporary cessation of operations, and of future policy generally. The outlook then was that, although a limited area containing better values lay immediately ahead of the dredge, the ground containing these values was buried by a bank of old tailings of such height as to make their recovery extremely difficult and an uneconomic proposition with tin at £600 per ton. However, by systematic manœuvring of the dredge, it was found possible successfully to deal with the high tailings bank and to recover the tin contained in the underlying ground with the result that in the first five months of 1953/54 the output was 235 tons of tin ore as compared with 89¼ tons in the corresponding period of 1952/53.

The net liquid assets position was a little less satisfactory at the end of 1951-52 than at the close of the previous year, but at £189,483 they are only fractionally below one-half of the issued capital.

Up to the time of going to press, only one interim dividend of 2½ per cent has been paid on account of 1952-53.

PENGKALEN LTD.

By September 30, 1952, Pengkalen had dredged about 452 acres of its land. It possesses approximately 800 acres of tin-bearing land at Pengkalen, Lahat, Malaya, and holds mining leases over another 226 acres; in addition it holds mining leases over 81 acres in the Kinta River area. It works the property with the aid of a single dredge which in 1951-52 continued on a southerly course following the trail of the old Kinta River, which had earlier been diverted. In 1951-52 conditions were described as good except for a brief spell early in the year when buried timber and slime caused some trouble. The central section of the Kinta River deviation was completed in 1951-52 and negotiations were commenced with the State Government for the construction of a new road bridge to replace the existing one, when the dredge has passed into the southern section of the property.

Stepping up the amount of ground treated from 1,923,000 cu. yd. to 2,091,000 cu. yd. did not produce a bigger tin ore output since the average value of the ground treated fell from 0.65 lb. per cu. yd. to 0.57 lb. per cu. yd. The slight fall in the amount of tin ore sold during 1951-52, together with the lower average price of tin, cut revenue down, and the effect of this movement was amplified by the increased cost of working. After allowing for a variety of comparatively small items, profits came out at £225,247 against £286,455, and once again taxation, amounting on this occasion to £127,187, took over half. Shareholders received, for the second year, dividends totalling 50 per cent on the ordinary shares and 60 per cent on the preference.

Although the full accounts of Pengkalen for 1952-53 are not yet available, it is clear from the quarterly reports that the financial results will not even reach 1951-52 levels. Output in the year to September 30, 1953, amounted to only 320¾ tons against 531 tons; this large reduction took place at a time when the price of tin was lower, and the adjustments in the dividend rate—only 30 per cent was paid on the ordinary and 40 per cent on the preference shares—foreshadowed the shape of the coming accounts.

The current year has started more auspiciously: output in the first half-year is up from 161¼ tons to 231¼ tons, and in the second quarter of the year the price of tin has been rising to more economic levels. It is unlikely, however, that the improvement in output will reach the heights of recent years, for a larger proportion of previously dredged ground is now being treated.

KENT (F.M.S.) TIN DREDGING LTD.

Kent (F.M.S.) Tin Dredging owns some 645 acres in the Kuala Lumpur area, Selangor, Malaya, of which 35 acres are held on a mining lease direct from the Government and 610 acres on a sub-mining lease, tribute being payable on a sliding scale based on the price of tin. This latter arrangement, though slightly complicated, is useful as it provides a small shock absorber when the price of tin declines.

Two factors combined to make the year to December 31, 1952, slightly less favourable than the preceding year: the average price received for tin ore dropped from £616 per ton to £572 per ton, and the closing of the dredge for a month for the conversion of its boiler from coal to oil-firing caused the amount of ground treated to contract from 1,717,900 cu. yd. to 1,531,000 cu. yd. Despite this decline mining costs rose from £77,232 to £84,888 and the gap was widened by the need to provide for the cost of deviating the Batu River into a new channel. The lower selling price of tin ore cut down the amount paid to the Government of Malaya as royalty, and income tax payable also shrank from £147,468 to £110,911. These reduced demands, however, only alleviated the position and net profits after tax totalled £60,559 as compared with £95,850.

During 1953, according to the quarterly reports, the quantity of tin ore produced fell from 478 tons to 414¾ tons. In these circumstances, shareholders do not need to wait for the full report for the year to know that the results will not match up with the satisfactory standard of 1952. The dividend payments also foreshadowed what the full report will tell: the first two interim dividends for 1953, totalling 35 per cent, were less than the corresponding dividends of 1952, which amounted to 50 per cent, and it is almost certain that a third interim for 1953, assuming one is paid, will be lower than the 20 per cent paid for 1952, making a total of 70 per cent for that year.

Although the early months of 1954 have seen a fairly persistent recovery in the price of tin, it has been less marked than the cut in output from 122½ tons to 95 tons, and the warning given by the chairman seems to have been well founded.

LONDON TIN CORPORATION

LIMITED

CAPITAL

Authorised: £4,200,000. *Issued:* £3,618,236, in shares of 4s. each, fully paid.

REGISTERED OFFICE - 55-61, MOORGATE, LONDON, E.C.2

PROVIDES, THROUGH ITS SUBSIDIARIES, TECHNICAL MANAGEMENT, FINANCIAL AND SECRETARIAL SERVICES FOR TIN-PRODUCING AND DEVELOPMENT COMPANIES IN MALAYA, SIAM, BURMA AND NIGERIA

MANAGEMENT ORGANISATION:

(Wholly-owned Subsidiary Companies):—

The Anglo-Oriental & General Investment Trust, Ltd. London

Anglo-Oriental (Malaya) Ltd. Kuala Lumpur, Fed. of Malaya

A. O. Nigeria, Ltd. - - - - Jos, Northern Nigeria

A. O. (Australia) Pty. Ltd. - - - - Sydney, N.S.W

Petaling Tin Ltd.

DESPITE good dredging conditions and the fact that all plant and machinery ran well, Petaling Tin, the important Malayan incorporated tin producer, was not able to derive the maximum benefit from its three dredges, Nos. 3, 5 and 6, during the year ended October 31, 1953.

This was because its No. 3 dredge—operating in the ground sub-leased from Petaling Rubber Estates—was transferred to another area after ten months' operations and docked so that alterations could be made to increase its digging depth. No. 5 dredge was shut down for a total of 45 days for unforeseen major repairs to its bucket ladder; and No. 6 dredge was shut down for 26 days for essential repairs to its main screen owing to delay in the delivery of a new screen.

Year to Oct. 31	*Treated Cu Yd.* (000)	*Per Cu. Yd. Yield* (lb.)	*Cost* (d.)	*Output in tons* (conc.)	*Per Ton Ore Cost* £	*Price** £
1953	7,734.1	0.53	10.9	1,847	192†	465‡
1952	9,563.1	0.47	11.2	2,003	222	577
1951	8,447.9	0.51	10.7	2,129	177	646

*Less tribute † Actual cost £191 11s. 5d. per ton ‡Actual price £464 10s. 5d. per ton

Nevertheless, the full impact of the dredging time lost was mitigated by the higher average grade of ground dredged. This favourable feature, together with the company's feat of achieving substantially lower production costs, made it possible to present a satisfactory picture of the year's technical operations. The fall in the average price received per ton tin ore, however, by approximately £112 per ton tin ore could not be offset with the result that mining revenue declined sharply.

Year to Oct. 31	*Mining Revenue** £	*Mining Costs†* £	*Taxation* £	*Net Profit* £	*Dividend* %	*Carry Forward* £
1953	866,025	353,850	124,367	281,572	70	115,961
1952	1,172,162	445,106	233,333	419,354	105	91,756
1951	1,391,139	377,536	259,000	645,880	150	109,222

* Proceeds from tin ore, gold, ilmenite and tribute collected. The 1952 figure also includes 2.8 tons of monazite. † Includes provision for plant renewals.

Total revenue from mining operation of £866,025 was made up from receipts from the sale of 1,847 tons tin ore amounting to £857,998; of 182 oz. gold amounting to £2,292; of 2,824 tons of ilmenite amounting to £4,451; and of receipts from tribute workings by gravel pumps in the Sungei Way north area, amounting to £1,284.

Although mining revenue compared with the preceding year was down by £306,137, the substantially lower production costs taken together with the reduced off-take in taxation gave the company a net profit only £137,782 less than in the previous year. Shareholders, as usual, were well treated, receiving two interims of 20 per cent followed by two of 10 per cent making, with the final of 10 per cent, a total distribution for the year of 70 per cent which required a net amount of £251,534. These distributions were paid on an issued capital which, at the current exchange rate of 2s. 4d. per Straits dollar, totals £513,333 divided into 4,400,000 shares of 2s. 4d. each. The carry forward was increased by £30,038 to £115,961.

In December last the company announced that arrangements had been completed for the acquisition of 600 acres of tin-bearing land from Castlefield (Klang) Rubber Estate. The portion selected for dredging contains an estimated 50,000,000 cu. yd. averaging 0.45 lb. per cu. yd., equivalent to a life of approximately ten years for the company's No. 6 dredge.

The outlook for the current year is good without being bright. Total output, at any rate, will show a modest decrease as the No. 5 dredge will be dismantled and re-erected at the Seaport Estate area; No. 3 dredge recommenced operations in March after having been shut down for approximately seven months for alterations to increase the digging depth; and finally, the No. 6 dredge was shut down in November last for approximately two months to install the new screen.

The loss of dredging time is reflected in the output for the first five months of the current year ending October 31, 1954, which at 607 tons compares with 806 tons produced in the corresponding period of the year under review; and in the first interim payment of 7½ per cent against a corresponding payment of 20 per cent a year ago.

In the longer terms, of course, Petaling Tin with its substantial financial resources—net current assets total £1,171,346—its three dredges which should soon be trouble free, and its large reserve of mining land, is well placed to cope with any foreseeable circumstances which may arise.

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Kinta Kellas Tin Dredging Co., Ltd.

THE results, technical and financial, achieved by Kinta Kellas Tin Dredging during the year ended March 31, 1953, were not good. Nor were they expected to be, marking as they did the end of a transition period which all dredging companies must experience at some time or other when the principle factor of production undergoes a major overhaul. However, a repair and maintenance task of the size indicated falls very heavily on Kinta Kellas as it has only one dredge with which to work its large Malayan property and therefore the additional problem is involved of reconciling the time consuming and unproductive repair and replacement work with the necessity of keeping the dredge in operation as much as possible to cover working expenses.

That the Company was carrying this burden was made known in January, 1953, when shareholders were advised that the Company had suffered a trading loss at the end of the first nine months of the year ended March 31, 1953. In fact, however, this information was implicit in the Company's monthly production returns which showed that in May and June, 1952, the output of tin concentrates amounted to only 9 tons—5 tons in May and 4 tons in June. Again in the autumn, production was reduced to 11 tons in September and 9 tons in October, so that the average production for these four months was less than 8 tons per month. Indeed, all points considered, the fact that the Company avoided closing down the dredge altogether, despite its 65 days of inactivity during the year, was commendable, as was the fact that the net result of the year's operations ended in a profit—albeit very small.

Year to Mar. 31	*Dredging Time (hours)*	*Per Cu. Yd. Dredged (000)*	*Yield (lb.)*	*Output (Tin Ore) (tons)*	*Per Ton Cost £*	*Tin Ore Price £*
1953	5,384	1,079.6	0.39	184	577	532
1952	5,444	1,062.1	0.50	237	362	581
1951	6,587	1,243.2	0.45	249	312	557

Indeed, the real villain of the piece was the grade of ground dredged which was the lowest treated by the Company since it was formed in 1926. That this should have occurred when major plant repairs and replacements were being carried out and during a period in which the price of tin was steadily falling played havoc with mining costs and dividend prospects.

The disadvantages attendant on working through low grade ground are clearly brought out in the above table which shows that while the dredge throughput remained virtually the same as in the preceding year, the output declined by 53 tons and as production costs advanced by as much as £215 per ton—a feature made worse by the drop in the price received by £49 per ton—the impact on the profit and loss account was particularly sharp.

Year to Mar. 31	*Tin Proceeds £*	*Gross Revenue £*	*Mining* Costs £*	*Taxation £*	*Net Profit £*	*Dividend %*
1953	104,325	116,224	113,505	Nil	609	Nil
1952	137,748	147,266	98,128	21,035	24,590	20
1951	138,605	144,083	90,039	35,006	15,689	25

* Including royalty payments and depreciation

Accordingly, tin proceeds fell by approximately £33,000 and although net revenue from tribute operations improved from £7,297 to £9,067, gross revenue at £116,224 could not compare with that attained in the preceding year amounting to £147,266. Mining costs, as foreshadowed above, were unusually heavy and represent an advance of some £15,000 over that expended in the preceding year. Other outgoings, including depreciation provisions of only £839 against £4,181, were less, no tax charges were attracted and the net profit was added to the forward balance which at the financial year stood at £11,162 compared with £10,553 brought in.

The balance sheet showed that current assets, excluding investments, had declined from £123,418 to £72,097, the principle changes accounting for the latest position being a rise in the value of stores by £14,425 to £36,055 and a fall in the cash resources by £64,059 to £15,076. Investments, at cost, were unaltered at £49,346, although their market value had risen from £46,650 to £48,730. Current liabilities, excluding provisions, also contracted, the decrease being £24,329 to £34,789, and provisions for dredge repairs and renewals were recorded at £23,086 against £26,965. Thus, current assets exceeded current liabilities by £63,568. Under "Fixed Assets" in the balance sheet the historical cost of the Company's dredge was given at £67,590, this has been depreciated down to £6,187.

Malaysiam Tin Ltd.

THE fact that Malaysiam Tin has now ceased mining on its own account and for the next three years will be largely dependent for its revenue on tribute operations, calls for a brief explanation.

For the past three years the company's operations have revolved around three sections of its mining leases in Perak; the Rambun section, the Sungei Choh section, both of which were nearing the end of their working lives, and an area known as Tanjong Ara. This latter section contains good values at depth but owing to the large amount of barren overburden overlying the virgin tin-bearing ground, the company has had to spend a disproportionate amount of time in preparing it for productive mining.

Year to Mar. 31	*Treated (cu. yd.)*	*Per Cu. Yd. Yield (lb.)*	*Cost s. d.*	*Output (tons)*	*Per Ton Ore Cost £*	*Price £*
1953	253,800	0.59	2 4	67	440	565
1952	397,500	0.31	1 10*	54	665*	580
1951	407,500	0.29	1 3	54.4	472	553

* Including cost of regrouping accommodation for labour force

In March, 1952, the former high-grade Rambun section was closed down apart from small-scale tribute operations in the floor of the paddock. About the same time the company discovered in the Sungei Choh section, long regarded as a low-grade area, a small but relatively rich lead hitherto unnoticed and overlain with sand and slimes.

Production was continued in the Tanjong Ara section, where development was being extended, and the Sungei Choh. In Tanjong Ara, the work of cutting and of establishing new sites for the two lift pumps was severely hampered by landslides and by the necessity of removing large stones from the paddock. Necessary repairs to the pipeline caused further loss of cutting time. Finally, a particularly severe landslide in February, 1953, completely overran the floor of the Tanjong Ara paddock. Thereafter, only a very much reduced output was possible, and in May, 1953, the company's consulting engineers, Osborne and Chappel, advised that the best method of dealing with the situation would be for the company to cease mining on its own account and to sub-let on a tribute basis all the company's mining leases in Perak.

The table opposite shows details of production over the three years to March 31, 1953, including a notable reduction in production costs in 1952/53 of no less than £225 per ton as compared with the preceding year. The impact of these results on the profit and loss account are clearly set out in the table below.

Year to Mar. 31	*Tin Proceeds* £*	*Mining Costs £*	*Taxation £*	*Net Profit £*	*To Reserve £*	*Carry Forward £*
1953	46,703	29,479	7,026	11,195	12,000	1,490
1952	37,808	31,541	3,044	4,734	3,000	2,295
1951	41,653	25,738	11,856	6,836	5,000	5,253

* Including net revenue from tributors' workings : 1953 £8,844, 1952 £6,511, 1951 £11,546

The net profit in 1952/53 was the highest recorded in the post-war period but even so the dividend was passed for the second year in succession. This decision, reluctantly taken, was dictated by the following circumstances. Firstly, the war damage award totalling £11,685 was a minor receipt compared with the company's original claim of over £65,000; secondly, no amortization had been provided for the Rambun or Glami leases which stood in the books at their original cost; and finally, total profits from tin and rubber during the first seven months of the year ended March 31, 1954, amounted to a mere £3,495 compared with £13,403 for the corresponding period of the year under review. Thus it was decided to raise general reserves to £55,000 by the allocation of £12,000 from the year's profits and to transfer £20,000 from this fund to write down the cost of the Rambun leases to £87,183 and to carry forward the remaining balance.

The tributing arrangement, which came into effect in August, 1953, for a period of three years, is based on royalty payments to the company of 20 per cent on the first 160 piculs sold per month and 25 per cent on all sales over that figure.

Tanjong Tin Dredging Ltd.

TANJONG TIN DREDGING owns leases covering some 638 acres in the Mukim of Teja, Kinta District, Perak, Malaya, and also 538 acres in lower Perak which it acquired in 1947 when it purchased the undertaking and assets of Sungei Luas Tin Dredging Ltd. The latter's 15 cu. ft. bucket dredge was transferred to the main area where it was re-erected as No. 2 dredge and commenced operations at the end of November, 1950.

Year to Dec. 31	*Dredged cu. yd.*	*Per Cubic Yard Yield (lb.)*	*Cost (d.)*	*Output tons*
1952	4,205,960	0.52	10.4	981
1951	4,397,400	0.59	8.6	1,154
1950	1,763,400	0.57	10.2	453

Although somewhat below the very high level of 1951, the results obtained by the company during 1952 were again exceptional. Both dredges operated with the maximum efficiency but the course followed by No. 2 dredge lay through an area already worked to a depth of some 60 ft. and containing a large proportion of tailings. This accounted for the decrease in output during 1952 and, of course, for the lower average recovery of tin ore per cu. yd. dredged. With the general rise in the cost of labour, etc., and the lower yardage treated, the working costs rose from 8.69d. to 10.46d. per cu. yd.

Year to Dec. 31	*Ore Sales†*	*Costs at mine*	*Taxation*	*Net Profit*	*Dividend*	*To Reserves*
	£	£	£	£	%	£
1952	577,746	184,515	236,650	139,180	80	25,000
1951	730,261	162,479	306,859	235,931	100	100,000*
1950	219,504	73,972	68,000	68,503	25	45,000*

* Excluding £1,000 allocated to investment reserve in both years.
† Less duty and charges, etc.

The average price received per ton of tin ore fell from £632 11s. 5d. per ton to £590 5s. 6d. per ton, so that revenue from ore sales suffered accordingly. Malayan Government Royalty charges amounted to over £108 per ton and, together with realization charges, required £111,047. Total mining costs were heavier, while tax liabilities, combined with the aforementioned Royalty charges, absorbed no less than 71.51 per cent of the profits, equivalent to £349.56 per ton. Part of this swingeing burden was accounted for by E.P.L. which took 7.8 per cent or £37,450, equivalent to £38.18 per ton produced. Shareholders received a net £78,050, equivalent to £79.59 per ton or only 16.28 per cent of the profits. The carry forward at the financial year end was £54,821 compared with £42,857.

STRONG BALANCE SHEET

The balance sheet at December 31, 1952, was strong. Net current assets amounted to £453,956, or nearly 2½ times the issued capital of £185,834. The balance sheet also revealed that, after allocating £25,000 from the year's profits, the general reserve stood at £200,000.

The sum of £23,241 was written off the rehabilitation account —a tidying up operation following the notification of the War Damage Commission's award which has enabled the company to clear off all outstanding loans from the Malayan Government. At the same time, the rehabilitation suspense account has been closed and the balance of £23,241 charged to the appropriation account, as it represents the excess of rehabilitation expenditure over the War Damage award.

By the end of 1952, No. 2 dredge had entered an area containing a large proportion of tailings left behind by the Japanese when they worked this portion of the property during the period of occupation. At the beginning of 1953, No. 2 dredge still had a large area of this already worked ground ahead of it, and the General Managers, Messrs. Osborne and Chappel, in their report attached to the report and accounts for 1952, anticipated that reduced outputs from this dredge were to be expected. As regards No. 1 dredge, they stated that it would be operating in virgin ground and that the prospects were favourable.

The declared monthly outputs for 1953 amounted to 780 tons against the exceptionally high output of 981 tons of tin ore in 1952.

During 1953 there was a severe fall in the tin price level and the all in all results cannot be expected to come up to those achieved during the previous year. This is perhaps reflected in the distribution to date, comprising four interim payments totalling 47½ per cent. For the year 1954 a first quarterly interim dividend of 7½ per cent was declared payable on April 7.

Kinta Tin Mines Ltd.

THE KINTA TIN MINES LTD. owns a mining area of over 1,000 acres near Gopeng in the Kinta District of Perak, Malaya, which is worked by hydraulicing. In addition, it has a half interest with Gopeng Consolidated Ltd. in the Sanglop Rubber Estate, of which some 800 acres are planted with rubber.

Results for the year 1952 were good, although the lower grade of ground treated resulted in a reduction in output compared with that of the previous year.

Year to Dec. 31	*Treated cu. yd.*	*Per Cubic Yard Yield (lb.)*	*Cost (d.)*	*Output tons*
1952	1,105,700	0.61	14.8	304
1951	855,000	1.00	17.0	381
1950	1,209,100	0.75	9.8	403

At the Lallang Section the company was engaged during the first part of the year in sinking in the floor of its new paddock from the 40 ft. level to the 70 ft. level, at which depth development was commenced towards the West and the South. In August, the company transferred the whole of its cutting water to the south where improved returns were obtained from the treatment of friable ground carrying fair values. Although at 656,400 cu. yd., the yardage treated in this section was greater by 65,100 cu. yd. than in the previous year, the yield per cu. yd. dropped to 0.75 lb. compared with 0.89 in 1951, with the result that the production from this section dropped from 236 tons to 220 tons of tin ore.

A somewhat similar story emerges from operations at the Damak Section where the yardage treated increased from 263,700 cu. yd. to 449,300 cu. yd. but the yield declined from 1.24 lb. to 0.43 lb. per cu. yd., and output fell from 145 tons to 84 tons. Thus the average yield from the two sections was 0.61 lb. per cu. yd., as against 1.00 lb. per cu. yd. in 1951. The greater volume of ground treated enabled a reduction in working costs per cu. yd. from 17.07d. to 14.80d. per cu. yd. but, with the fall in the general tin price level, the average price received per ton tin ore was down to £572 7s. 2d. per ton as against £629 2s. 10d. per ton, in 1951.

Year to Dec. 31	*Ore Sales**	*Costs at mine*	*Taxation*	*Net Profit*	*Dividend*	*To Reserve*
	£	£	£	£	%	£
1952	174,771	68,952	70,901	60,720	40	Nil
1951	240,514	62,397	140,070	78,583	75	28,500
1950	188,696	50,539	98,511	65,024	65	32,000

* Less duty and charges

Gross revenue for the year 1952 totalled £211,955 compared with £295,220 in 1951. Mining costs were heavier, while taxation liabilities and the aforementioned Royalty charges paid to the Malayan Government absorbed as much as 63.28 per cent of the profits or a sum equivalent to £341 per ton. Shareholders received a net payment of £25,200 representing only 15.37 per cent of the profits earned, or the equivalent of £82.81 per ton. The carry forward at the end of 1952 was £24,726 compared with £13,954 brought in.

IMPROVED OUTPUT IN 1953

In their report attached to the report and accounts for the year 1952, the General Managers, Messrs. Osborne and Chappel, anticipated that, in 1953, an improved output would be obtained from the operation of the electrically-driven gravel pumps then shortly to be installed at the Lallang Section, but that production from the Damak Section would continue at a low level until values in depth were reached in the new paddock to be opened up in the middle of the year.

The declared monthly outputs for 1953 amounted to 339½ tons of tin ore, a rise of 35 tons on the output for 1952.

So far four interim dividends have been paid in respect of 1953 totalling 32½ per cent. For the year 1954 a first quarterly interim dividend of 7½ per cent was declared payable on April 7.

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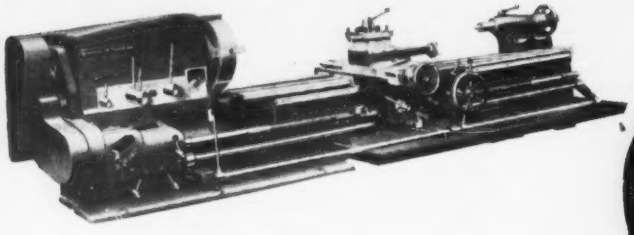

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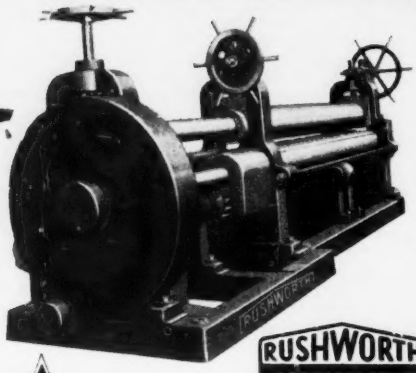

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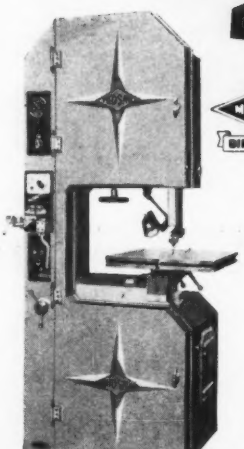

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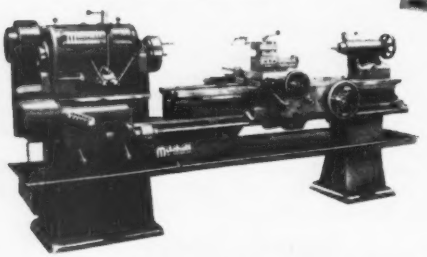

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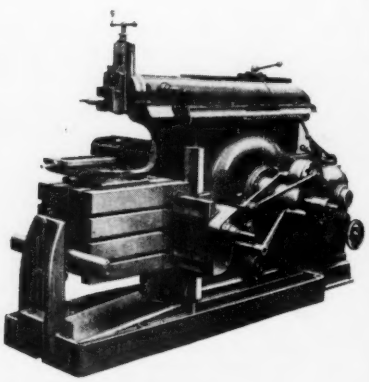

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Siamese Tin Syndicate Ltd.

SIAMESE TIN SYNDICATE LTD., already the largest tin mining company in Siam, has consolidated and extended its position by the acquisition, during 1953, of the whole of the issued capital of Bangrin Tin Dredging Co., Ltd.

The two companies had been closely associated since 1920 when Bangrin was formed for the purpose of working certain tin-bearing properties acquired from Siamese Tin Syndicate. In 1947, uniformity had been achieved in the managerial, technical and administrative organizations of the two companies and from the beginning of 1949 the directorates had been identical. This administrative arrangement had been of great benefit, but it was felt that with the increasing complexity of modern taxation and certain other factors, the full benefits of co-operation could only be realized by closer financial association.

The operation was approved at an extraordinary general meeting of stockholders on July 9, 1953, when the company's authorized capital was increased from £200,000 to £550,000, of which up to £250,000 was to be utilized in the Bangrin purchase. Siamese Tin already held £20,000 stock in the Bangrin company, and the remaining £280,000 issued capital was duly acquired, on acceptance of the offer by that company's stockholders, towards the end of the year.

Concurrently with the above, there was a cash distribution to stockholders (foreshadowed by the chairman, Mr. K. O. Hunter, in more than one statement during the preceding two years) of 2s. 6d. on each existing 5s. stock unit. A bonus issue of one new 5s. stock unit for each 5s. stock unit was also made.

Turning to the company's operations for the year 1952, the salient statistics for which are given in the accompanying tables, it is noteworthy that the volume of ground treated and the tonnage of tin ore produced were both post-war records. This was largely due to the successful return to operations of the Kota Bahru dredge operated by the company's wholly-owned Malayan subsidiary, Siamese Tin Syndicate (Malaya) Ltd., which produced 303 tons of the total output as against only 66 tons in the preceding year.

Prospecting was carried out during the year with mixed results. Two large dredging areas were bored under option, but results were disappointing and the options were allowed to lapse. A rock mining prospect was also abandoned owing to irregularity of values. On the other hand, scout boring carried out in the Upper Ngow Leases indicated at least 10,000,000 cu. yd. of tailings which might be re-dredged profitably. The company's endeavour to prepare for dredging, in conjunction with Bangrin, a property at Chemor, Malaya, which had been prospected in 1930, is dealt with in the article on Bangrin Tin Dredging Co., Ltd.

At the end of 1952, reserves stood at 132,872,750 cu. yd., averaging 0.506 lb. tin ore per cu. yd.

With regard to the company's lead-zinc venture in the Wanlockhead-Leadhills area in Scotland, now operated jointly with the Rio Tinto Co. Ltd. under the name of Lowland Lead Mines, preparations for the dewatering of the Glencrieff Section were made in accordance with the programme laid before stockholders at an extraordinary general meeting held on July 4, 1952.

The outlook for the company in 1953, notwithstanding the lower tin price prevailing and the demands of E.P.L., which took £48,450 during 1952, is encouraging. The output of tin ore was about 1,859 tons, excluding tonnage recovered from tin shed tailings, so that it may finally be near to 2,000 tons.

Relevant statistics are as follows:—

Year	*Dredged (000 cu. yd.)*	*Yield (lb./cu. yd.)*	*Output (tons Ore)*	*Per Ton Ore Price* £	*Duty* £	*Tin Ore Proceeds* £
1952	8,872	0.46	1,833†	675	93	1,256,008
1951	7,469	0.47	1,564*	720	103	1,170,954

* Exc. 61 tons recovered from tailings. † Exc. 28 tons recovered from tailings.

Year	*Mining Revenue* £	*Mining* Costs* £	*Taxation† £*	*Net Profit* £	*Dividend %*	*Carry Forward* £
1952	1,257,926	701,274	327,458	198,356	150	51,857
1951	1,172,141	681,264	311,800	177,535	150	43,501

* Including export duty on tin ore which amounted to £167,189 in 1951 and £172,532 in 1952. † Net Siam and U.K. estimated taxation.

Bangrin Tin Dredging Ltd.

DURING the year under review, 1952, the company's No. 2 dredge, after being dismantled, was removed from Siam to Chemor (a property in North Kinta, Perak, Malaya, owned by Siamese Tin Syndicate Ltd.) with a view to its reconstruction and operation on this property as a joint venture of the two companies on equal terms. A great deal of time and trouble was taken in the establishment of a defensible camp on the property, which was in one of the worst bandit areas. When excavating the erecting dock, however, a limestone bottom was encountered where none had been disclosed by the original drilling carried out in 1930 by Siamese Tin Syndicate. It was therefore decided that it would be necessary to have the property rebored, but terrorist activity at the time rendered European supervision of this work dangerous and it was decided that it would have to be postponed. The No. 2 dredge, which has been written down to a nominal value, therefor remains dismanted at Chemor on care and maintenance.

The No. 3 dredge underwent a major overhaul between mid-March and August, 1952, in consequence of which it is hoped that no further extensive repairs to this dredge will be required during the life of the present leases.

For five months of 1952, therefore, the company was conducting its operations with only one of its three dredges, with a corresponding loss of output and revenue. Offsetting this, however, the Siamese Government's claim for export duty fell from £122,252 to £61,973; the U.K. tax was reduced by £133,089 to £139,641; and, with substantially lower mining costs, the net profit for the year at £78,302 was down by only £54,601 compared with the preceding year. The total dividend distribution of 35 per cent, paid as to two interims of 7½ per cent and a final of 20 per cent, required a net £56,625, and after allocating £14,761 to general reserve, which raised that fund to £100,000, the carry forward rose by £6,916 to £38,190.

As a result of the reduction in the number of operating dredges, the company's electric generating station has been working on a light load so that the cost per unit of power supplied is uneconomical. Methods by which this cost can be reduced are being actively considered.

The ore reserve position is good. At the end of 1952 total reserves were estimated at 35,400,000 cu. yd., averaging 0.56 lb. tin ore per cu. yd. Leaving aside 4,700,000 cu. yd., averaging 0.72 lb. per cu. yd., which lie in isolated blocks or are considered to be more suitable for working by gravel pump, there remained 30,700,000 cu. yd., averaging 0.53 lb. per cu. yd., which comprised the future dredging area. This yardage included an additional 954,000 cu. yd. which were disclosed by prospecting operations on the company's properties during the year.

The outlook for the company in 1953 and subsequent years should, of course, be considered in conjunction with that of Siamese Tin Syndicate Ltd., of which Bangrin is now a wholly-owned subsidiary. As stated in the article on the Siamese Tin Syndicate Ltd., that company has achieved an encouraging production during 1953. Bangrin's results with two dredges in operation throughout the year also show an improvement; total production for 1953 amounted to 752¼ tons, which is an increase over the previous year of 70 tons excluding tonnage recovered from tin shed tailings.

Relevant statistics are as follows:—

Year	*Dredged (000 cu. yd.)*	*Yield (lb./cu. yd.)*	*Output (tons Ore)*	*Per Ton Ore Price* £	*Duty* £	*Tin Ore Proceeds* £
1952	2,245	0.68	681†	675	90	463,945
1951	3,423	0.72	1,098*	710	108	803,783

* Excluding 34 tons recovered from tin shed tailings.
† Excluding 6 tons recovered from tin shed tailings.

Year	*Mining Revenue* £	*Mining* Costs* £	*Taxation† £*	*Net Profit* £	*Dividend %*	*Carry Forward* £
1952	463,945	231,167	139,641	78,302	35	38,190
1951	803,783	391,892	272,730	132,903	70	31,274

* Including export duty on tin ore which amounted to £122,252 in 1951, and £61,973 in 1952.
† Net Siam and U.K. estimated taxation.

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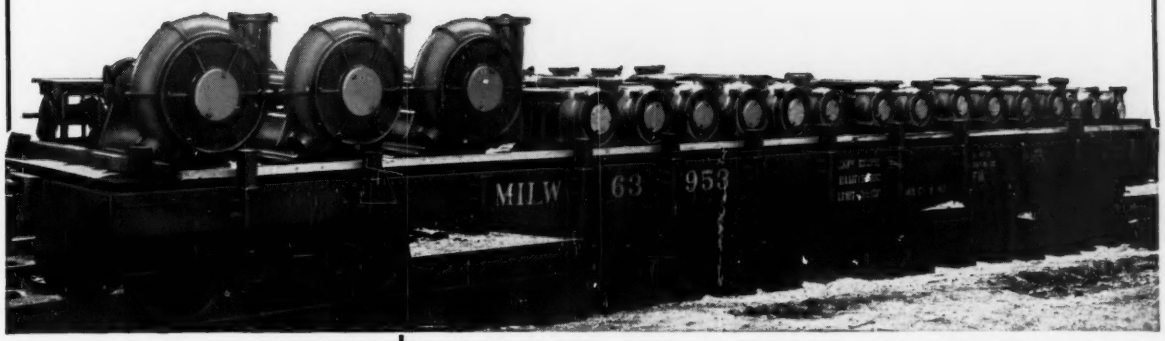
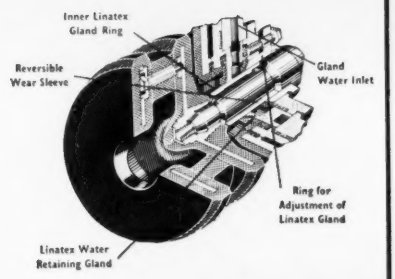
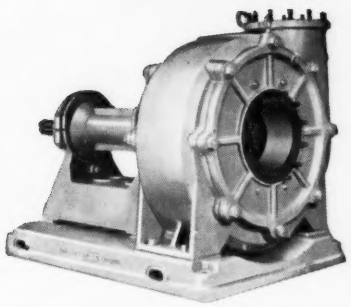



Inner Linatex Gland Ring
Reversible Wear Sleeve
Gland Water Inlet
Ring for Adjustment of Linatex Gland
Linatex Water Retaining Gland



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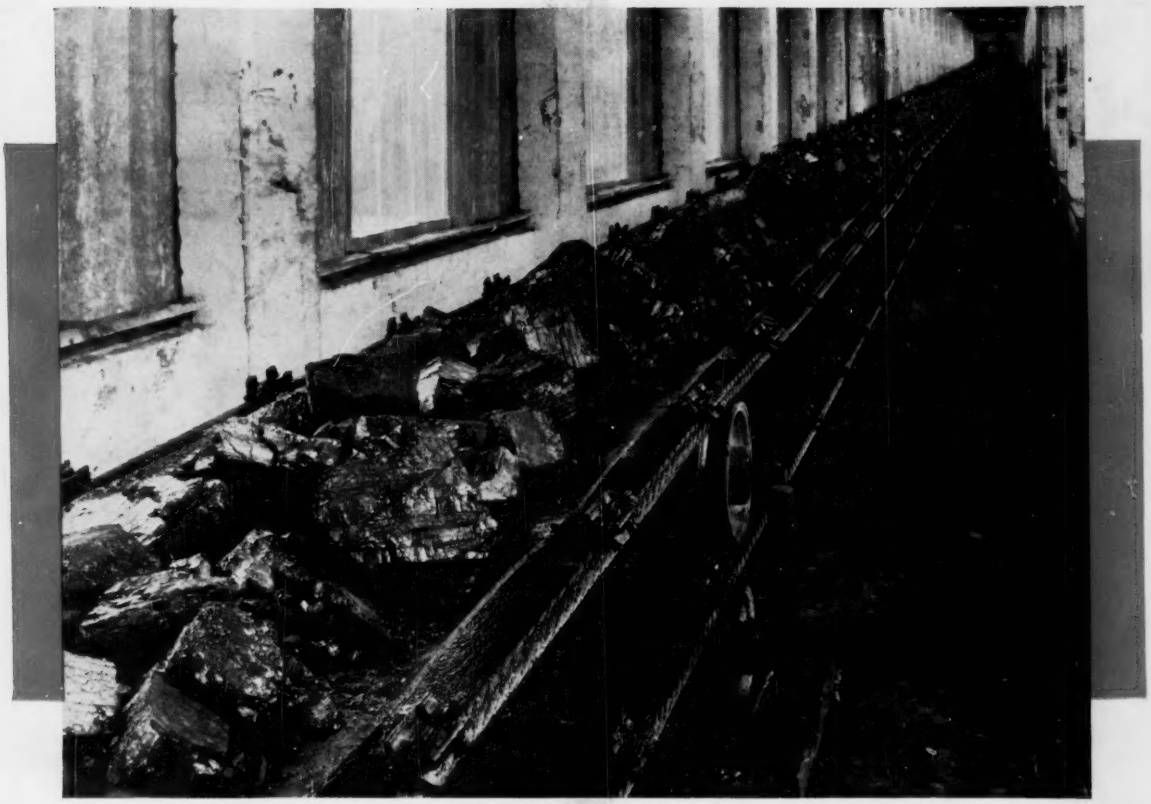

Cable Belt Conveyor handling 300 tons per hour run of mine coal. Length of conveyor 1,800 yards. Lift 600 ft.

Economic long distance material handling using a

CABLE BELT CONVEYOR

Economies effected are

CAPITAL COST. Initial cost usually lower than comparable conveyor installations.

BELT COST. Initial cost is low—belt wear is negligible—edge wear eliminated.

MANPOWER SAVING. Eliminates tandem point attendants, tub handlers, etc. and reduces number of men for cleaning up spillage.

SPILLAGE. Due to steadiness of system, spillage is negligible.

MAINTENANCE. Ropes supporting pulleys are pitched at approx. 20ft. intervals thereby greatly reducing lubrication. One C.B.C. replaces a series of conventional belt conveyors. This means maintenance of only one Driving Unit and Tail End Unit.

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DEGRADATION OF MATERIAL. Absence of tandem points reduces material degradation.

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